This manual includes:

- Start-Up Data
- Software Description
- Signals
- Parameters
- Overview of the CDP312 Control Panel
- Fault Tracing
- Terms
Safety

**General Safety Instructions**

**Note:** Complete safety instructions can be found in the *Safety and Product Information Manual (ACS 600 MultiDrive)*, or in the *Hardware Manual (ACS/ACC 607)*.

These safety instructions are intended for all work on the ACS 600 MultiDrive and the ACS/ACC 607 (630 to 3000 kW) units. Neglecting these instructions can cause physical injury and death.

**WARNING!**

All electrical installation and maintenance work on the ACx 600 should be carried out by qualified electricians.

Any installation and maintenance work must be done with the power off and power is not to be reconnected until the installation work is complete. Dangerous residual voltages remain in capacitors when the disconnecting device is opened. Wait 5 minutes after switching off the supply before starting work. Always ensure that the measured voltage between terminals UDC+ and UDC- and frame is close to 0 V and that the supply has been switched off before performing any work on the equipment or making main circuit connections.

If the main circuit of the inverter unit is live, the motor terminals are also live even if the motor is not running!

Open the fuse switches of all parallel connected inverters before installation or maintenance work in any of them.

Check the cable connections at the shipping split joints before switching on the supply voltage.

If the auxiliary voltage circuit of the ACS 600 is powered from an external power supply, opening the disconnecting device does not remove all voltages. Control voltages of 115/230 VAC may be present on the digital inputs or outputs even though the inverter unit is not powered. Before starting work, check which circuits remain live after opening of the disconnecting device by referring to the circuit diagrams for your particular delivery. Ensure by measuring that the part of the cabinet you are working on is not live.
In ACx 600 frequency converters, control boards of the converter unit may be at the main circuit potential. Dangerous voltages may be present between the control cards and the frame of the converter unit, when the main circuit voltage is on. It is critical that the use of measuring instruments, such as an oscilloscope, are used with caution and safety and always a priority. The fault tracing instructions give a special mention of cases in which measurements may be performed on the control boards, also indicating the measuring method to be used.

Live parts on the inside of doors are protected against direct contact. Special attention shall be paid to safety when handling shrouds made of sheet metal.

Do not make any voltage withstand tests on any part of the unit while the unit is connected. Disconnect the motor cables before making any measurements on the motors or motor cables.

**WARNING!** Close fuse switches of all parallel connected inverters before starting the frequency converter.

**Do not open the drive section switch fuses when the inverter is running.**

**Do not use Prevention of Unexpected Start for stopping the drive when the inverter is running. Give a Stop command instead.**

**CAUTION!** Fans may continue to rotate for a while after the disconnection of the electrical supply.

**CAUTION!** Some parts, like heatsinks of power semiconductors inside of cabinet remain hot for a while after the disconnection of the electrical supply.
## Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>i</td>
</tr>
<tr>
<td>General Safety Instructions</td>
<td>i</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>iii</td>
</tr>
<tr>
<td>Chapter 1 – Introduction to This Manual</td>
<td>1-1</td>
</tr>
<tr>
<td>Overview</td>
<td>1-1</td>
</tr>
<tr>
<td>Before You Start</td>
<td>1-1</td>
</tr>
<tr>
<td>What This Manual Contains</td>
<td>1-1</td>
</tr>
<tr>
<td>Chapter 2 – Start-up</td>
<td>2-1</td>
</tr>
<tr>
<td>Overview</td>
<td>2-1</td>
</tr>
<tr>
<td>General Start-up Instructions</td>
<td>2-1</td>
</tr>
<tr>
<td>POWER-UP</td>
<td>2-2</td>
</tr>
<tr>
<td>START-UP DATA</td>
<td>2-3</td>
</tr>
<tr>
<td>Entering and Checking Data</td>
<td>2-3</td>
</tr>
<tr>
<td>Activating the Optional Modules</td>
<td>2-4</td>
</tr>
<tr>
<td>Checking the I/O Communication</td>
<td>2-4</td>
</tr>
<tr>
<td>Checking the Prevention of Unexpected Start-up and Emergency Stop Circuit</td>
<td>2-4</td>
</tr>
<tr>
<td>Checking the Motor Fan Circuit (if exists)</td>
<td>2-4</td>
</tr>
<tr>
<td>MOTOR ID RUN = MOTOR IDENTIFICATION RUN</td>
<td>2-5</td>
</tr>
<tr>
<td>Checking the Speed Measurement and Rotation Direction</td>
<td>2-5</td>
</tr>
<tr>
<td>Selecting the Motor ID Run Mode</td>
<td>2-7</td>
</tr>
<tr>
<td>Multi-Motor Drives</td>
<td>2-8</td>
</tr>
<tr>
<td>OPTIMISING THE STARTING TIME AND TORQUE</td>
<td>2-8</td>
</tr>
<tr>
<td>MOTOR PROTECTIONS</td>
<td>2-9</td>
</tr>
<tr>
<td>Motor Thermal Model Protection</td>
<td>2-9</td>
</tr>
<tr>
<td>Motor Protection with Temperature Measurement</td>
<td>2-10</td>
</tr>
<tr>
<td>TUNING THE SPEED CONTROLLER</td>
<td>2-11</td>
</tr>
<tr>
<td>Step Response Test</td>
<td>2-11</td>
</tr>
<tr>
<td>Low Speed Fine Tuning</td>
<td>2-13</td>
</tr>
<tr>
<td>Suppression of Oscillations</td>
<td>2-13</td>
</tr>
<tr>
<td>SCALAR CONTROL</td>
<td>2-14</td>
</tr>
<tr>
<td>Selecting the Scalar Control</td>
<td>2-14</td>
</tr>
<tr>
<td>IR Compensation</td>
<td>2-14</td>
</tr>
<tr>
<td>CONTROLLING THE DRIVE USING AN OVERRIDING SYSTEM</td>
<td>2-15</td>
</tr>
<tr>
<td>CONTROLLING THE DRIVE USING THE I/O SIGNALS</td>
<td>2-16</td>
</tr>
<tr>
<td>FIELD BUS ADAPTERS</td>
<td>2-17</td>
</tr>
<tr>
<td>Activating the Undervoltage Control</td>
<td>2-17</td>
</tr>
<tr>
<td>AUTO RESTART FUNCTION</td>
<td>2-18</td>
</tr>
<tr>
<td>Activating the AUTO RESTART Function</td>
<td>2-18</td>
</tr>
<tr>
<td>CHECKING THE MASTER/FOLLOWER COMMUNICATION</td>
<td>2-18</td>
</tr>
<tr>
<td>Checking the Mode and Signals</td>
<td>2-18</td>
</tr>
<tr>
<td>DriveWindow Backup/Restore Function</td>
<td>2-20</td>
</tr>
<tr>
<td>Before You Start</td>
<td>2-20</td>
</tr>
<tr>
<td>Complete Backup</td>
<td>2-20</td>
</tr>
<tr>
<td>Parameter Saving</td>
<td>2-21</td>
</tr>
</tbody>
</table>
Table of Contents

DriveWindow Restore ........................................................................................................ 2-22

Chapter 3 – Software Description ............................................................................. 3-1

   Drive Functions ........................................................................................................ 3-1
   General ....................................................................................................................... 3-1
       Application Program Identification ...................................................................... 3-2
       Program Boot ....................................................................................................... 3-2
   Control Diagrams ...................................................................................................... 3-2
   Control Modes .......................................................................................................... 3-5
       REMOTE Mode ..................................................................................................... 3-5
       HAND/AUTO Function ......................................................................................... 3-5
       LOCAL Mode ....................................................................................................... 3-5
   Emergency Stop .......................................................................................................... 3-5
       Emergency Stop Hardware .................................................................................... 3-5
       Torque Limit Ramping beginning of Emergency Stop ............................................ 3-6
       Emergency Stop Modes ......................................................................................... 3-6
       Action if the Motor Is Stopped ............................................................................... 3-6
       Action if the Motor Is Running ............................................................................... 3-6
   Prevention of Unexpected Start-Up ........................................................................... 3-7

Communication .............................................................................................................. 3-8

   DDCS Channels in NAMC CONTROLLERS ............................................................... 3-8
   Fieldbus Communication Adapters on the Channel CH0 ........................................... 3-8
       Fieldbus Signals .................................................................................................... 3-9
       Addressing of Data Using Data Sets 10...33 ......................................................... 3-9
       The Mail Box Function ......................................................................................... 3-9
       Integer Scaling on the DDCS Link ....................................................................... 3-9
       Received Data Set Table ....................................................................................... 3-10
       Transmitted Data Set Table .................................................................................. 3-11
       Using the NPBA-02 PROFIBUS Adapter Module .................................................. 3-12
       PROFIBUS Parameters in Cyclic Communication .................................................. 3-12
   I/O Devices on Channel CH1 ..................................................................................... 3-13
   Master/Follower Link on Channel CH2 ...................................................................... 3-13
   Commissioning and Supporting Tools on Channel CH3 ............................................ 3-13
   Modbus Link ............................................................................................................... 3-13
       Register Read and Write ....................................................................................... 3-14
       Register Mapping .................................................................................................. 3-14
   Charging Logic of Inverter ......................................................................................... 3-15
   ABB Drive Profile .................................................................................................... 3-15
   Drive States ............................................................................................................... 3-15
   Main Control Word (MCW) ...................................................................................... 3-17

I/O Configurations ........................................................................................................... 3-24

   Digital Inputs ............................................................................................................. 3-24
       Hardware Source Selection for Digital Inputs ....................................................... 3-24
   Digital Outputs .......................................................................................................... 3-24
       Hardware Source Selection for Digital Outputs .................................................... 3-25
   Analogue Inputs ........................................................................................................ 3-25
       I/O Speed Reference ............................................................................................. 3-25
       NIOC-01 Basic I/O Board ...................................................................................... 3-26
       NBIO-21/NIOB-01 Analogue Inputs ...................................................................... 3-26
       NAIO-03 Analogue I/O Extension Module .............................................................. 3-27
   Analogue Outputs ...................................................................................................... 3-28
   NIOB-01 Basic I/O .................................................................................................... 3-31
   Board Connections .................................................................................................. 3-31
   Pulse Encoder Interface NTAC-02 ......................................................................... 3-34
Table of Contents

The Master / Follower Link ............................................................................................................................... 3-34
  General .......................................................................................................................................................... 3-34
  Link Configuration ........................................................................................................................................ 3-34
    Master Drive ........................................................................................................................................... 3-34
    Follower Drive(s) .................................................................................................................................... 3-35
  Flying Switching between Speed and Torque Control ............................................................................ 3-35
  Follower Diagnostics ................................................................................................................................. 3-36
    Master/Follower Link Specification ......................................................................................................... 3-36

Diagnostics .................................................................................................................................................. 3-36
  General ....................................................................................................................................................... 3-36
  Fault and Event Loggers ........................................................................................................................... 3-36
    AMC Time Format and Counting .............................................................................................................. 3-36
  Data Loggers 1 and 2 ................................................................................................................................. 3-37

Positioning Counter ..................................................................................................................................... 3-37
  Positioning Counting Function ................................................................................................................ 3-38

Back-Up of Parameters or Software ........................................................................................................... 3-39
  Spare NAMC Boards ................................................................................................................................. 3-39
  DriveWindow Back-Up Function ............................................................................................................... 3-40
  DriveWindow Restore Function .............................................................................................................. 3-40

Memory Handling ....................................................................................................................................... 3-41
  User Macros ............................................................................................................................................. 3-41

Oscillation Damping ..................................................................................................................................... 3-42
  Tuning Procedure .................................................................................................................................... 3-42

AUTO RESTART Function ............................................................................................................................ 3-43

Chapter 4 – Signals .......................................................................................................................................... 4-1
  Overview ................................................................................................................................................... 4-1
  How to Read the Signal Table .................................................................................................................. 4-1

AMC Table Signals ...................................................................................................................................... 4-2
  Group 1 Actual Signal ............................................................................................................................... 4-2
  Group 2 Actual Signals ............................................................................................................................. 4-4
  Group 3 Actual Signals ............................................................................................................................. 4-5
  Group 4 Information .................................................................................................................................. 4-8
  Group 7 Control Words ............................................................................................................................. 4-9
  Group 8 Status Words ............................................................................................................................... 4-11
  Group 9 Fault Words ............................................................................................................................... 4-14

Chapter 5 – Parameters .................................................................................................................................. 5-1
  Overview ................................................................................................................................................... 5-1
  Parameter Groups .................................................................................................................................... 5-1
  How to Read the Parameter Table ............................................................................................................ 5-2
    Group 10 Start/Stop/Dir ............................................................................................................................. 5-3
    Group 11 Reference Select ..................................................................................................................... 5-6
    Group 13 Analogue Inputs ..................................................................................................................... 5-6
    Group 14 Digital Outputs ....................................................................................................................... 5-7
    Group 15 Analogue Outputs .................................................................................................................. 5-9
    Group 16 System Control Inputs .......................................................................................................... 5-12
    Group 17 DC Hold ................................................................................................................................... 5-13
    Group 18 LED Panel Inputs .................................................................................................................... 5-14
    Group 19 Data Storage ............................................................................................................................ 5-15
    Group 20 Limits ..................................................................................................................................... 5-16
    Group 21 Start/Stop Functions ............................................................................................................... 5-19
    Group 22 Ramp Functions ...................................................................................................................... 5-22
    Group 23 Speed Reference ..................................................................................................................... 5-24
### Table of Contents

**Chapter 6 - Overview of the CDP 312 Control Panel** ................................................................. 6-1  
Overview ........................................................................................................................................... 6-1  
Panel Link ......................................................................................................................................... 6-1  
  - Display ............................................................................................................................... 6-2  
  - Keys ....................................................................................................................................... 6-2  
Panel Operation ................................................................................................................................. 6-3  
  - Keypad Modes ...................................................................................................................... 6-3  
    - Identification Display ........................................................................................................ 6-3  
    - Actual Signal Display Mode ............................................................................................. 6-3  
    - Parameter Mode .................................................................................................................. 6-7  
    - Function Mode .................................................................................................................... 6-9  
    - Copying Parameters from One Unit to Other Units .......................................................... 6-11  
    - Setting the Contrast ........................................................................................................... 6-11  
    - Drive Selection Mode ......................................................................................................... 6-11  
  - Operational Commands ........................................................................................................... 6-14  
    - Start, Stop, Direction and Reference .................................................................................. 6-14

**Chapter 7 – Fault Tracing** ........................................................................................................... 7-1  
Overview ........................................................................................................................................... 7-1  
Protocols ........................................................................................................................................... 7-1
Table of Contents

I/O- Monitoring .............................................................................................................................. 7-1
Communication Monitoring ............................................................................................................. 7-1
Inverter Overttemperature Fault ..................................................................................................... 7-1
Ambient Temperature ................................................................................................................... 7-1
Overcurrent ................................................................................................................................... 7-1
DC Overvoltage ............................................................................................................................. 7-2
DC Undervoltage ........................................................................................................................... 7-2
Local Control Lost Function .......................................................................................................... 7-3
RUN ENABLE Interlocking Function ............................................................................................ 7-3
START INHIBITION Interlocking Function .................................................................................... 7-3
Short Circuit .................................................................................................................................. 7-3
Intermediate DC Link Current Ripple Fault ................................................................................... 7-3
Overspeed Fault ............................................................................................................................. 7-3
Earth/Fault Logics .......................................................................................................................... 7-4

Indicator LEDs in the NINT Board ........................................................................................................... 7-5
Interpretation of the LEDs ............................................................................................................. 7-5
Speed Measurement Fault ............................................................................................................ 7-6
Switching from Measured Speed to Estimated Speed ................................................................. 7-7
Overswitching Frequency Fault .................................................................................................... 7-7
System Fault .................................................................................................................................. 7-7
Short Time Overloading ................................................................................................................ 7-7
  Overloading between $I_{AC, Nominal}$ and $I_{AC, 1/5 \text{ min}}$ .................................................... 7-7
  Overloading between the $I_{AC, 1/5 \text{ min}}$ and Maximum Current ........................................ 7-8
Motor Protections .................................................................................................................................... 7-9
Motor Thermal Protection Functions ............................................................................................. 7-9
  Motor Thermal Model .................................................................................................................. 7-9
Usage of PT100, PTC or KTY84-1xx Temperature Sensors ......................................................... 7-10
Stall Function .................................................................................................................................. 7-11
Underload Function ....................................................................................................................... 7-12
Motor Phase Loss Function ............................................................................................................ 7-12
Earth Fault Protection Function ..................................................................................................... 7-13
Motor Fan Diagnostics .................................................................................................................. 7-13
Diagnostics ...................................................................................................................................... 7-13

Fault and Alarm Messages ............................................................................................................. 7-14
Fault Message Table ....................................................................................................................... 7-14
Alarm Message Table ..................................................................................................................... 7-21
Event Messages ............................................................................................................................. 7-25
Other Messages ............................................................................................................................. 7-25

Chapter 8 - Terms ........................................................................................................................... 8-1
Table of Contents
Chapter 1 – Introduction to This Manual

Overview
This chapter describes the purpose, contents and the intended audience of this manual. It also explains the terms used in this manual and lists related publications.

Before You Start
The purpose of this manual is to provide you with the information necessary to control and program the drive.

Read through this manual before commencing start-up.

The installation and commissioning instructions given in the ACS 600 MultiDrive Hardware Manual must also be read before proceeding.

Study carefully the Safety Instructions before attempting any work on, or with, the unit.

What This Manual Contains
Safety Instructions can be found at the beginning of this manual.

Chapter 1 – Introduction to This Manual, the chapter you are reading now, introduces you to this manual.

Chapter 2 – Start-Up, explains the Start-up procedure.

Chapter 3 – Software Description, explains the operation of the System Application Program.

Chapter 4 – Signals, introduces you to the measured or calculated signals.

Chapter 5 – Parameters, lists the System Application Program parameters and explains their functions.

Chapter 6 – Overview of CDP 312 Control Panel, describes the operation of the CDP 312 Control Panel used for controlling and programming.

Chapter 7 – Fault Tracing, introduces you to the protections and fault tracing of ACS 600.

Chapter 8 – Terms, gives complete listing of the terms used in this manual.
Chapter 1 – Introduction to This Manual
Chapter 2 – Start-up

Overview

This chapter describes the basic start-up procedure of the ACS 600. The instructions are given as a step-by-step table. A more detailed description of the parameters involved in the procedure is presented in the chapter Parameters.

General Start-up Instructions

The ACS 600 frequency converter can be operated:
- locally from its Control Panel or the DriveWindow PC tool.
- externally via the I/O connections on the NIOC or NIOB board or fieldbus connection to the NAMC board.

The start-up procedure presented uses the DriveWindow program. (For information on the functions of DriveWindow, see its on-line help.) However, parameter settings can also be given via the Control Panel. To display references without Data Logger, connect and scale the analogue outputs to an oscilloscope.

The start-up procedure includes actions that need only be taken when powering up the ACS 600 for the first time in a new installation (e.g. entering the motor data). After the start-up, the ACS 600 can be powered up without using these start-up functions again. The start-up procedure can be repeated later if the start-up data needs to be altered.

Refer to the chapter Fault Tracing in case problems should arise. In case of a major problem, disconnect mains power and wait for 5 minutes before attempting any work on the unit, the motor, or the motor cable.
## START-UP PROCEDURE

<table>
<thead>
<tr>
<th>1.</th>
<th><strong>POWER-UP</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>Apply mains power.</td>
</tr>
<tr>
<td>☐</td>
<td>Start the DriveWindow program.</td>
</tr>
<tr>
<td>☐</td>
<td>Select the DDCS protocol.</td>
</tr>
<tr>
<td>☐</td>
<td>Switch the DriveWindow program into Local control mode.</td>
</tr>
</tbody>
</table>

- **Follow the safety instructions during the start-up procedure.**
- **The start-up procedure should only be carried out by a qualified electrician.**
- Check the mechanical and electrical installation and the commissioning of the drive section from the ACS 600 XXX Hardware Manual *(Code 3AFY 63700118).*
- Connect optical cables temporarily between the NAMC board channel CH3 and the DDCS communication (NISA) card or PCMCIA card in the PC.
  - When using a PCMCIA card, follow the instructions included in the DriveWindow kit.
- Disconnect the overriding system link from channel CH0 of the NAMC board.
START-UP PROCEDURE

2. START-UP DATA

2.1 Entering and Checking Data

- Upload the parameter and signal list.
- Select the language (if available). Reload the parameter and signal list from the Drive menu.
- Enter the motor data from the motor nameplate into the following parameters (Parameter Group 99):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>99.01</td>
<td>LANGUAGE</td>
</tr>
<tr>
<td>99.02</td>
<td>MOTOR NOM VOLTAGE</td>
</tr>
<tr>
<td>99.03</td>
<td>MOTOR NOM CURRENT</td>
</tr>
<tr>
<td>99.04</td>
<td>MOTOR NOM FREQ</td>
</tr>
<tr>
<td>99.05</td>
<td>MOTOR NOM SPEED</td>
</tr>
<tr>
<td>99.06</td>
<td>MOTOR NOM POWER</td>
</tr>
<tr>
<td>99.12</td>
<td>MOTOR NOM COSFII</td>
</tr>
</tbody>
</table>

  If the nominal COS $\phi$ of the motor is unknown, set Parameter 99.13 POWER IS GIVEN to POWER.

  Field Weakening Point Values!

- Download the parameters.

  The Alarm Message "ID MAGN REQ" is displayed.
## START-UP PROCEDURE

### 2.2 Activating the Optional Modules

- Activate all optional modules connected to channel CH1 of the NAMC board.

  **Note:** If the pulse encoder is used with NIOB-01 basic I/O board, set also Parameter 98.01 = YES

  **Parameter Group 98**
  **OPTION MODULES**

### 2.3 Checking the I/O Communication

- Check the possible I/O signal selections.

  **Parameter Groups 10 - 15**

### 2.4 Checking the Prevention of Unexpected Start-up and Emergency Stop Circuit.

- Check that the *prevention of unexpected start-up circuit* works including digital input START INHIBIT function.
  
  \[
  \begin{align*}
  1 &= \text{Active (NGPS-xx 230/115 VAC circuit is open)} \\
  0 &= \text{Normal State (circuit is closed)}
  \end{align*}
  \]

  **Signal 8.02 AUX STATUS**
  **WORD bit B8**
  **START_INHIBITION.**
  **10.08 START INHIB DI**

- Set the mask for Prevention of Unexpected Start-up alarm for ALARM /FAULT logger, if the NGPS-xx is often de-energised. Otherwise the alarm / fault logger will be filled with START INHIBIT alarms.

  **Signal 8.01 MAIN STATUS**
  **WORD bit B5 OFF_3_STA**
  **31.02 START INHIBIT ALM**

- Check that the *emergency stop circuit* is functioning correctly (DI1 and DO1).
  
  \[
  \begin{align*}
  1 &= \text{NO OFF 3.}
  \end{align*}
  \]

- Select the emergency stop mode.

  **21.04 EME STOP MODE**

### 2.5 Checking the Motor Fan Circuit (if exists).

- Check the fan control circuit, set any required functions by parameters.

  **35.01 MOTOR FAN CTRL**
  **35.02 FAN ACK DELAY**
  **35.03 FAN OFF DELAY**
  **35.04 FAN ON DELAY**
  **10.06 MOTOR FAN ACK**
### START-UP PROCEDURE

#### 3. **MOTOR ID RUN = MOTOR IDENTIFICATION RUN**

#### 3.1 Checking the Speed Measurement and Rotation Direction

<table>
<thead>
<tr>
<th>With a pulse encoder</th>
<th>Without a pulse encoder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Check the rated speed value of the motor (e.g. 1485 rpm).</td>
</tr>
<tr>
<td></td>
<td>Set Parameter 50.03 <strong>SPEED FB SEL</strong> to INTERNAL (default value).</td>
</tr>
<tr>
<td></td>
<td>Set the number of pulses per revolution for the encoder.</td>
</tr>
<tr>
<td></td>
<td>Check the other parameters settings in Parameter Group 50.</td>
</tr>
<tr>
<td></td>
<td>Reset and start the motor.</td>
</tr>
<tr>
<td></td>
<td>The stator resistance and other electrical losses are identified and stored into FPROM memory. The motor shaft is not rotating during the FIRST START.</td>
</tr>
<tr>
<td></td>
<td>The motor stops after the FIRST START has been performed.</td>
</tr>
<tr>
<td></td>
<td>Start the motor again.</td>
</tr>
<tr>
<td></td>
<td>Enter a small (e.g. 50 rpm) value for the speed reference.</td>
</tr>
<tr>
<td></td>
<td>Check that the motor shaft actually turns to the correct direction and the polarity of the speed measurement is correct.</td>
</tr>
</tbody>
</table>
### START-UP PROCEDURE

When the motor is rotating in the correct direction and the speed reference is positive, then the actual speed in Signal 1.03 SPEED MEASURED must be positive as well and equal to Signal 1.02 SPEED ESTIMATED. If this is not the case, the incorrect connection can be located as follows:

- If the direction of rotation is correct and signal 1.03 SPEED MEASURED is negative, the phasing of the pulse encoder channel wires is reversed.
- If the direction of rotation is incorrect and signal 1.03 SPEED MEASURED is negative, the motor cables are connected incorrectly.
- If the direction of rotation is incorrect and signal 1.03 SPEED MEASURED is positive, both the motor and the pulse encoder are connected incorrectly.

#### Changing the direction:

- Disconnect mains power from the ACS 600, and wait about 5 minutes for the intermediate circuit capacitors to discharge!
- Do the necessary changes and verify by applying mains power and starting the motor again. Check that the speed actual value is positive.

---

**An input channel connection of the NTAC-02.**

<table>
<thead>
<tr>
<th>Box</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image.png" alt="Diagram" /></td>
<td>Stop the motor.</td>
</tr>
<tr>
<td><img src="image.png" alt="Diagram" /></td>
<td>Set Parameter 50.03 SPEED FB SEL to 2 = ENCODER. <strong>50.03 SPEED FB SEL</strong></td>
</tr>
<tr>
<td><img src="image.png" alt="Diagram" /></td>
<td>Start the motor.</td>
</tr>
<tr>
<td><img src="image.png" alt="Diagram" /></td>
<td>Check that the signals SPEED ESTIMATED and SPEED MEASURED are the same. <strong>1.02 SPEED ESTIMATED 1.03 SPEED MEASURED</strong></td>
</tr>
<tr>
<td><img src="image.png" alt="Diagram" /></td>
<td>Stop the motor.</td>
</tr>
</tbody>
</table>
## START-UP PROCEDURE

### 3.2 Selecting the Motor ID Run Mode

#### Warning!

The motor will run at up to approximately 50% - 80% of nominal speed during the Motor ID Run. BE SURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE MOTOR ID RUN!

- Select the Motor ID Run.

During the Motor ID Run, the ACS 600 will identify the characteristics of the motor for optimum motor control. The ID Run may take a few minutes, depending on motor size.

- **Select the STANDARD OR REDUCED ID Run if**
  - operation point is near zero speed,
  - maximum dynamic torque performance is required (motor model optimisation) and operation without a pulse encoder is required.

- **Select the FIRST START ID Run if**
  - it is a pump or fan application,
  - there are drive sections in which more than one motor is connected to one inverter. See 3.3 Multi-Motor Drives.

**Note:** The Motor ID Run cannot be performed if scalar control mode is selected for motor control (Parameter 99.08 MOTOR CTRL MODE is set to SCALAR).

#### 99.07 MOTOR ID RUN

- **1 = NO (FIRST START)**
  The Motor ID Run is not performed. If the start command has been given, the motor model is calculated by the ACS 600 by magnetising the motor for 20 to 60 s at zero speed.

- **2 = STANDARD**
  Performing the Standard Motor ID Run guarantees the best possible control accuracy. The motor and the driven equipment must be uncoupled for the Standard ID Run.

- **3 = REDUCED**
  The Reduced ID Run should be selected (instead of Standard) if mechanical losses are higher than 20% (i.e. the motor cannot be uncoupled from the driven equipment), or flux reduction is not allowed when the motor is running (e.g. a braking motor in which the brake switches on when the flux falls below a certain level).

#### If you select the Standard ID Run, uncouple the driven equipment from the motor!

**WARNING!** If the Standard ID run is to be performed with the machinery coupled to the motor, make sure the machinery is able to withstand the fast speed changes during the ID Run. Otherwise select the Reduced ID Run.

#### Check that starting of the motor does not cause any danger!

#### Start the motor.

- The motor stops after the ID Run has been performed.

When the ID Run has been successfully performed, **AUX STATUS WORD** signal 8.02 B7 IDENTIF_RUN_DONE is set to 1. Parameter 99.07 **MOTOR ID RUN** also changes back to NO.
START-UP PROCEDURE

Note: If the Motor ID Run has not been successfully performed (for example it does not finish), see Chapter Fault Tracing.

FAULT MESSAGE

"ID RUN FLT"

3.3 Multi-Motor Drives

These are drive sections in which more than one motor is connected to one inverter. The motors must have the same relative slip, nominal voltage and number of poles.

Notice! If scalar control is used, then these limitations are not effective.

☐ Set the sum of motor nominal currents. 99.03 MOTOR NOM CURRENT

☐ Set the sum of motor nominal powers. 99.06 MOTOR NOM POWER

☐ If the powers of the motors are close to each other or the same, but nominal speeds vary a little, Parameter 99.05 MOTOR NOM SPEED can be set to an average value of the motor speeds.

☐ If the powers of the motors vary a great deal, then use of scalar control is recommended. Notice! If scalar control is used then these limitations are not effective.

☐ Set the frequency of the motors (must be same). 99.04 MOTOR NOM FREQ

☐ The Motor ID Run can be performed with all the motors connected or without load. 99.07 MOTOR ID RUN

4. OPTIMISING THE STARTING TIME AND TORQUE

☐ Select the start function.

The fastest starting is achieved when Parameter 21.01 START FUNCTION is set to 1 (AUTO, flying start).

The highest possible starting torque is achieved when Parameter 21.01 START FUNCTION is set to 2 = DC magnetising or 3 = constant DC magnetising. Note: No support for flying start function.

☐ When CONST DC MAGN mode is used: shaft movement during the magnetising can be minimised.

☐ Set the limit parameters according to process requirements.

Parameter Group 20 LIMITS
## START-UP PROCEDURE

### 5. MOTOR PROTECTIONS

#### 5.1 Motor Thermal Model Protection

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Select the motor thermal model protection mode.</td>
<td>30.01 MOTOR THERM PMODE</td>
</tr>
<tr>
<td></td>
<td>Note: DTC mode is used for ABB motors with $I_n$ up to 800 A. Above that USER MODE is the only valid selection.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With USER MODE set according to motor manufacturer data.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With DTC mode</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Select the protection function for the motor thermal model protection.</td>
<td>30.02 MOTOR THERM PROT</td>
</tr>
<tr>
<td></td>
<td>FAULT / WARNING / NO.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Set the time for 63% temperature rise</td>
<td>30.09 MOTOR THERM TIME</td>
</tr>
<tr>
<td></td>
<td>Set the motor load curve current.</td>
<td>30.10 MOTOR LOAD CURVE</td>
</tr>
<tr>
<td></td>
<td>Set the zero speed load. Especially with forced cooling of the motor.</td>
<td>30.11 ZERO SPEED LOAD</td>
</tr>
<tr>
<td></td>
<td>Set the break point value for motor load curve.</td>
<td>30.12 BREAK POINT</td>
</tr>
<tr>
<td></td>
<td>Set the temperature alarm limit of the motor thermal model.</td>
<td>30.28 THERM MOD ALM L</td>
</tr>
<tr>
<td></td>
<td>Set the temperature trip limit of the motor thermal model.</td>
<td>30.29 THERM MOD FLT L</td>
</tr>
<tr>
<td></td>
<td>Set the motor nominal temperature rise. If ABB motor specifies MNTRC value on the rating plate, multiply value by 80 °C and enter the result here.</td>
<td>30.30 MOT NOM TEMP RISE</td>
</tr>
<tr>
<td></td>
<td>Set the typical ambient temperature of motor.</td>
<td>30.31 AMBIENT TEMP</td>
</tr>
</tbody>
</table>
## START-UP PROCEDURE

### 5.2 Motor Protection with Temperature Measurement

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Unit / Symbol</th>
<th>Scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT100</td>
<td>Celsius / °C</td>
<td>Normal 0…1,5 kΩ</td>
</tr>
<tr>
<td>PTC</td>
<td>Ohm / Ω</td>
<td>Overtemperature ≥ 4 kΩ</td>
</tr>
<tr>
<td>KTY84-1xx Silicon temperature sensor</td>
<td>Ohm / Ω</td>
<td>90°C == 939 Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>110°C == 1063 Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>130°C == 1197 Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150°C == 1340 Ω</td>
</tr>
</tbody>
</table>

- Select the motor temperature measurement function for MOTOR 1.
- Set the temperature alarm limit for MOTOR 1.
- Set the temperature trip limit for MOTOR 1.
- Select the motor temperature measurement function for MOTOR 2.
- Set the temperature alarm limit for MOTOR 2.
- Set the temperature trip limit for MOTOR 2.

- 30.03 MOT1 TEMP AI1 SEL
- 98.06 AI/O EXT MODULE 1
- 30.04 MOT1 TEMP ALM L
- 30.05 MOT1 TEMP FLT L
- 30.06 MOT2 TEMP AI2 SEL
- 98.06 AI/O EXT MODULE 1
- 30.07 MOT2 TEMP ALM L
- 30.08 MOT2 TEMP FLT L
START-UP PROCEDURE

6. **TUNING THE SPEED CONTROLLER**

When tuning the drive, change one parameter at a time, then monitor the response to a speed reference step possible oscillations. To achieve the best possible result, the step response tests should be carried out at different speeds, from minimum speed up to maximum speed.

The speed control values obtained depend mainly on:

- Flux reference 27.03 **FLUX REF**.
- The relationship between the motor power and the rotating mass.
- Backlashes in the drive’s mechanical structure (filtering).

**Note:** The Thyristor Supply Unit TSU may have to be set to normal operation mode for step response tests (signal 10407=0). If the TSU is in the diode bridge mode, an overvoltage alarm may trip the drive section when a stepped change down is given. Extra “jumps” may also appear in the step when the DC voltage rises, because no braking occurs.

6.1. **Step Response Test**

**Automatic Tuning**

The speed controller includes an automatic speed tuning function Parameter **24.01 PI TUNE**. The function is based on an estimate of the mechanical time constant. If this does not bring a satisfactory result, manual tuning can be performed as well.

**Manual Tuning**

- Select, for example, the following signals on the DriveWindow Monitoring Tool:
  - **1.07 MOTOR TORQUE FILT2**, actual torque
  - **1.03 SPEED MEASURED**, actual speed
  - **2.03 SPEED ERROR NEG**, filtered speed difference

- Start the motor. Increase the speed slightly. Give a speed reference step and monitor the response. Repeat at a few test values across the whole speed range.

- Set step changes of 1% or 2% from the maximum speed of the drive for DriveWindow.

- Optimise the P part of the speed controller: Set integration time to the maximum value. This turns the PI controller into a P controller.

- Give a step change up, e.g. 20 rpm. When the speed is stabilised, give a step change down e.g. 20 rpm.

- DriveWindow Drives Panel

- 23.10 SPEED STEP

- 24.09 TIS

- 23.10 SPEED STEP
### START-UP PROCEDURE

<table>
<thead>
<tr>
<th>Increase the relative gain until the response is sufficient.</th>
<th><strong>24.03 KPS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Gain too low</td>
<td><img src="image" alt="Gain too low" /></td>
</tr>
<tr>
<td>- Gain too high</td>
<td><img src="image" alt="Gain too high" /></td>
</tr>
<tr>
<td>- Gain optimal</td>
<td><img src="image" alt="Gain optimal" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reduce the integral time constant until overshoot is observed in the response.</th>
<th><strong>24.09 TIS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Integration time too long</td>
<td><img src="image" alt="Integration time too long" /></td>
</tr>
<tr>
<td>- Integration time too short</td>
<td><img src="image" alt="Integration time too short" /></td>
</tr>
<tr>
<td>- Integration time optimal</td>
<td><img src="image" alt="Integration time optimal" /></td>
</tr>
</tbody>
</table>

If the drive is stable and allows a high proportional gain, the integral time constant can be set short and an overcompensated step response is obtained.
### 6.2 Low Speed Fine Tuning

In order to eliminate potentially harmful oscillations at low speeds (for example, during start), parameters 50.13 ZERO DETECT DELAY and 50.14 SPEED HOLD TIME should be adjusted at this point.

The larger the mass of the driven equipment, the higher the value of 50.13 should be. As a rule of thumb, 50.14 should be set to approx. 60% of 50.13. For example, typical values for a drive rotating a dryer section of a paper machine would be 50 ms and 30 ms respectively.

| 50.13 ZERO DETECT DELAY | 50.14 SPEED HOLD TIME |

### 6.3 Suppression of Oscillations

The measured speed always has a small ripple because of gear play and flexible couplings. However, a small ripple is acceptable as long as it does not affect the control loops. Reduction of this ripple with filters may cause tuning problems later on. A long filter time constant and a fast acceleration time contradict each other.

- If the speed measurement shows rapid oscillation, filter it by means of speed error filter and setting the time constant of the first order actual speed filter. With the combination "no gear box" and "pulse encoder feedback", decrease SP ACT FILT TIME to a minimum if fast oscillation is observed.

| 23.06 SPEED ERROR FILT | 50.06 SP ACT FILT TIME |

- If there is substantial backlash in the drive, and if the drive oscillates at low torque due to the mechanism, the situation can be remedied by means of the adaptive control parameters. If the adaptivity has to be made abrupt (24.03 KPS high and 24.04 KPS MIN low), the drive may start to oscillate as the load varies. Use a step to test the functioning of the adaptivity. The step can be higher than 20 rpm (e.g. 50 rpm).

| 24.04 KPSMIN | 24.05 KPS WEAKPOINT | 24.06 KPS WP FILT TIME |
# START-UP PROCEDURE

## 7. Scalar Control

### 7.1 Selecting the Scalar Control

The scalar control mode is recommended for multimotor drives when the number of motors connected to ACS 600 is variable.

Scalar control is also recommended when the nominal current of the motor is less than 1/6 of the nominal current of the inverter, or the inverter is used for test purposes with no motor connected.

- Start the drive with DTC mode (FIRST START) before selecting the scalar control mode.  
  99.07 MOTOR ID RUN
- Select the scalar control mode. 
  Parameter group 29 becomes visible after selection of scalar control. Parameters 29.02 FREQUENCY MAX and 29.03 FREQUENCY MIN are updated by software according to parameters 20.02 MAXIMUM SPEED and 20.01 MINIMUM SPEED.

### 7.2 IR Compensation

IR compensation, or boosting the inverter output voltage, is often necessary to obtain an optimal start torque, or when the motor must rotate slowly, i.e. at a low frequency. Due to the stator winding resistance an additional voltage will be needed when even a slight load torque exists.

- Set the operating range for the IR compensation. Starting voltage Ua (at zero frequency), can be set to 0% to 30% of motor nominal voltage. Select a combination at which the motor is able to start and run at a constant speed over the whole speed range.  
  29.04 IR_COMPENSATION

![U/F characteristic diagram](image)

**U/F characteristic**
START-UP PROCEDURE

Always supervise the temperature rise in motors running at low speeds with IR compensation, particularly if no separate fan or temperature monitoring is included.

The adequacy of IR compensation must be checked under actual load conditions.

8. CONTROLLING THE DRIVE USING AN OVERRIDING SYSTEM

The drive can be controlled from an overriding system by using data sets 1, 2 or 10...33 with DDCS and DriveBus communication protocols.

☐ Select the data sets used in the overriding system. Typically FBA DSET10.

☐ Connect the overriding system optic fibres to the channel CH0 of the NAMC board.

☐ Set the node address for channel CH0 according to the application of the overriding system.

<table>
<thead>
<tr>
<th>Controller</th>
<th>Node Addresses</th>
<th>Node Addresses</th>
<th>Node Addresses</th>
<th>Par 70.01 CH0 NODE ADDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>APC2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>NO</td>
</tr>
<tr>
<td>AC70</td>
<td>-</td>
<td>-</td>
<td>17-125</td>
<td>NO</td>
</tr>
<tr>
<td>AC80 DriveBus</td>
<td>-</td>
<td>1-12</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td>AC80 ModuleBus</td>
<td>-</td>
<td>17-125</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>FCI (DB10A)</td>
<td>-</td>
<td>-</td>
<td>17-125</td>
<td>NO</td>
</tr>
</tbody>
</table>

☐ Select the communication mode for channel CH0. See the table above. Note: This parameter is valid after the next power-up.

☐ Check that the communication is working.

☐ Set the delay time before a communication break fault is indicated.

☐ Select the action upon a communication fault on channel CH0.

☐ Select RING, if the CH0 channels on the NAMC boards have been connected to ring. (Default is STAR that is typically used with the branching units NDBU-95 / -85).
### START-UP PROCEDURE

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>Set the node address for channel CH3. This is used for DriveWindow. Use addresses 1…75 and 124…254. Rest of the addresses have been reserved for branching units (NDBU-95 or NDBU-85). If the CH3 channels of several drives have been connected in a ring or star (using a branching unit configuration), each one must be given a unique node address. The new node address becomes valid only on the next NAMC-03 power-on.</td>
<td>70.15 CH3 NODE ADDR</td>
</tr>
<tr>
<td>☐</td>
<td>Select RING, if the CH3 channels on the NAMC boards have been connected to ring. (Default is STAR that is typically used with the branching units NDBU-95 or NDBU-85).</td>
<td>70.20 CH3 HW CONNECTION</td>
</tr>
<tr>
<td>☐</td>
<td>Select the addresses for Receive and Transmit data according to the application of the overriding system. Note the different update intervals. See tables in the Chapter 3 Fieldbus Communication Adapters on the Channel CH0.</td>
<td>Parameter Groups 90…93</td>
</tr>
<tr>
<td>☐</td>
<td>Test the functions with received and transmitted data.</td>
<td></td>
</tr>
</tbody>
</table>

#### 9. CONTROLLING THE DRIVE USING THE I/O SIGNALS

The drive can be controlled, instead of an overriding system, by using I/O signals. See also Par. 10.07 HAND/AUTO.

| ☐ | Select the I/O control mode (1=NO). Digital inputs are selected in Group 10 Digital Inputs. To see the analogue selections see description of Parameter 98.06 AI/O EXT MODULE 1. When an NIOC-01 I/O board is used, an mA-type speed reference signal can be selected with the parameter 11.01 EXT REF1 SEL. | 98.02 COMM MODULE |
## START-UP PROCEDURE

### 10. FIELDBUS ADAPTERS

See the appropriate *Installation and Start-up Guide*. The fieldbus communication is set up with Parameter Group 51.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Parameter Group 51</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>71.01 CH0 DRIVEBUS MODE</td>
<td></td>
</tr>
</tbody>
</table>

Select the DRIVEBUS MODE OFF and reconnect the power to the NDCU-unit.

### 11. UNDervoltage Control

#### 11.1 Activating the Undervoltage Control

It is possible to keep the drive running during a short power supply failure (max. 5 seconds) on the following provisions:

- The NAMC board must be powered through a UPS.
- Digital input DI2 circuit must remain closed during the power supply failure.
- The inverter is permitted to run for max. 5 seconds without inverter fans.

Please contact an ABB representative for more information.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>30.22 UNDervoltage CTL</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>20.14 ADAPtive UDC MEAS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>20.16 UNDervolt TORQ DN</strong> and (20.15)</td>
<td></td>
</tr>
</tbody>
</table>

Check that the auxiliary control circuit functions correctly during power supply failure.

Activate the undervoltage controller.

Deactivate the Adaptive UDC measurement if undervoltage control is in use with several drives connected to the same DC bus.

Tune the generating load level according to the load with the gain of the P-controller.
## START-UP PROCEDURE

### 12. AUTO RESTART FUNCTION

#### 12.1 Activating the AUTO RESTART Function

It is possible to restart the drive automatically after a short power supply failure using the AUTO RESTART function.

- **Activate the AUTO RESTART function if required.**
- It is possible to restart the drive after a short power supply failure (max. 5 seconds) on the following provisions:
  - The NAMC board must be powered through a UPS.
  - Digital input DI2 circuit must remain closed during the power supply failure.
  - The inverter is permitted to run for max. 5 seconds without inverter fans.

- **Set the maximum allowed power supply failure time.**

- **Set the PPCC FAULT MASK to prevent PPCC link fault indications.**

### 13. CHECKING THE MASTER/FOLLOWER COMMUNICATION

#### 13.1 Checking the Mode and Signals

Required only if the application includes master/follower drives.

- **Select the Master/Follower mode.**

- **In the Master: If the speed reference is sent from the master drive to the follower drive, select the signal (to be sent to the follower).**

**Note:** If Parameter 70.08 CH2 M/F MODE is set to 3 = FOLLOWER, this parameter is not used.
## START-UP PROCEDURE

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| □ | **In the Master:** The torque reference is sent from the master drive to the follower drive. Select the signal to be sent as the torque reference (from the master drive to the follower). | **70.11 MASTER SIGNAL 3**  
*Note:* If Parameter 70.08 CH2 M/F MODE is set to 3 = FOLLOWER, this parameter is not used. |
| □ | **In the Follower:** If the speed reference is read from the master drive, set Parameter 70.17 FOLL SPEED REF to 1 = MASTER in the follower. | **70.17 FOLL SPEED REF** |
| □ | **Test the load sharing in practice. Also test the function with an emergency stop.** | **25.03 LOAD SHARE** |
DriveWindow Backup/Restore Function

When finishing the ACS 600 commissioning it is recommend making a backup file of the NAMC board parameters. If required the parameters can then be downloaded into a spare board of the same type.

Before You Start

For COMPLETE BACKUP function the DriveWindow shortcut must be edited as follows.

1. Add parameter ‘/A’ to command line, e.g. ‘C:\ABBTOOLS\DRIWINDW.EXE /A’
2. Mark the Run in separate memory Space field.

DriveWindow Complete Backup:

COMPLETE BACKUP saves the PARAMETER.DDF file from the NAMC board including nominal values of the inverter. The file extension is *.DDB.

Make Complete Backup always after changing parameter values! Save also the parameter list after making changes.

Complete Backup

1

Start the DriveWindow; all the connected drives are shown on tree display.

2

Select a drive by clicking on the icon with left mouse button.

3

In the DriveWindow select: Drive >> Backup >> Create complete backup >> OK.
Parameter Saving

1. Select the drive by clicking the icon with left mouse button. Open parameter list.

2. Open all parameter groups.

3. Select the disc and directory for saving the parameters (e.g. D:\1234xf\pm007\dw_data\param).

4. Write the file name (for example drive number), maximum 8 characters.

5. In the next window you can also write a comment.
DriveWindow Restoring Complete Backup:

Restoring a **COMPLETE BACKUP** downloads the whole contents of the PARAMETER.DDF file to FPROM (Flash PROM memory) on the NAMC board. This is the easiest and the recommended way to download parameters to a spare board, because it also restores the inverter nominal values. **The board and loading package types** (e.g. NAMC-21 and AM4B5230) of the original and spare board must match. See signal 4.1 in the drive.

<table>
<thead>
<tr>
<th></th>
<th>INFORMATION</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>SW PACKAGE VER</td>
<td>AM4B5220</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>DTC SW VERSION</td>
<td>0x00005220</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>APPLIC SW VERSION</td>
<td>AM4B5220</td>
<td></td>
</tr>
</tbody>
</table>

**DriveWindow Restore**

1. Disconnect CH0 optical cable from the NAMC-board.
2. Connect DriveWindow directly to NAMC-board CH3 with optical cable.

In the DriveWindow select: **Drive >> Restore** and select the directory, where complete Backup files is stored. **Note:** Complete Backup must not use for version updates (e.g. AM4B5230 -> AM4B5250).

(e.g. D:\1234xf\pm007\dw_data\backups\complete)

3. From list files of type selection box chance file type to ‘Complete Backup Files’
4. Select file (e.g.11.DDB) and click **OK**.
5. Reset the error message **Version Conflict** by clicking **Yes**, if the only difference is that the Backup and Target Node numbers are different.
Chapter 2 – Start-up

6
After the notification **Restore successfully done** and the error message (see the picture on right) have appeared, turn off and on the auxiliary voltage of the NAMC-board (restart). Connect DW to the drive and check parameters, step 8.

**Version Conflict** message, see step 7.

7
Notification **Version Conflict**: the system program and the backup file are of different versions. Load the correct system program. See a separate guide. Otherwise continue from step 8.

8
Open parameter list and open all parameter groups:

**Signals and Parameters >> Group >> Open All Groups.**

9
Compare the opened list to the saved parameter file:

**File >> Compare**, select the Parameter-file, e.g. (D:\1234\pm007\dw\data\param) ’11.DWP’.

10
Some parameter groups may have different values, like reference values, limits and data (parameter groups: 19, 20, 21, 23, 25, 26), because the control system (AC 80, APC) updates the values.

11
Reinstall all connections as they were before making restore. Reconnect +24 V DC to the NAMC-51 board.
Chapter 3 – Software Description

Drive Functions

This chapter describes the typical functions of the ACS 600 drive.

General

The motor control of ACS 600 frequency converter is based on the direct control of motor torque (DTC) by means of the stator flux. The inverter power semiconductors (switches) are regulated to achieve the required stator flux and torque of the motor. The power module “switching reference” is changed only if the values of the actual torque and the stator flux differ from their reference values more than the allowed hysteresis. The reference value for the torque controller comes either from the speed controller or directly from an external source.

The motor control requires the measurements of the intermediate circuit voltage and two phase currents of the motor. The stator flux is calculated by integrating the motor voltage in vector space. The torque of the motor is calculated as a cross product of the stator flux and rotor current. By utilising the identified motor model, the stator flux estimate is improved. The measurement of the shaft speed is not needed for the motor control. Good dynamic control performance is achieved providing the identification run is done during the commissioning.

The main difference between traditional control and the DTC is that the torque control is made at the same time level as the control of power switches (25 μs). There is no separate voltage and frequency controlled PWM modulator. All selections of the switches are based on the electromagnetic state of the motor.
Chapter 3 – Software Description

The DTC can only be applied by using high speed signal processing technology. Digital signal processors (MOTOROLA 560xx) are used in ACS 600 products to achieve this performance.

Application Program Identification

Each ACS 600 product has a product specific loading package, which contains all necessary software files to be downloaded to the NAMC board. The loading packages define for example the inverter ratings which are different for AC and DC supplied inverters. Loading Package type information can be identified from the signal 4.01 SW PACKAGE VER. There are two different types of loading packages for ACS 600 System Application:

- **AM4G6xxx** for non parallel connected inverters (e.g. 100 kVA)
- **AM5G6xxx** for parallel connected inverters (e.g. 4 x R11i)

The downloaded application program version can be identifiable from signal 4.03 APPLIC SW VERSION.

Program Boot

The application program on the NAMC board is saved into FPROM memory. After switching on the auxiliary power, the program starts routines for initialisation and loading of all tasks, parameters and application program from FPROM to RAM memory. This takes about 6 seconds. A reset is given at the end of the boot procedure, and the control mode of the drive is changed to REMOTE.

Control Diagrams

The speed control is executed once per millisecond in the fixed part of the software (speed ramp every 2 ms). The following figures show the speed and torque control chains.
Chapter 3 – Software Description

Figure 3 - 2  Speed Control Chain
**Control Modes**

The ACS 600 System Application Program has two main control modes: **REMOTE** and **LOCAL**. The mode is selected by the LOC/REM key on either from the CDP 312 control panel or the DriveWindow tool.

**REMOTE Mode**

A drive is controlled either through the DDCS communication link from an overriding system or from the drive I/O. The desired alternative is selected by parameter **98.02 COMM MODULE**. A digital input can also be selected for changing the control location.

**HAND/AUTO Function**

This mode is suitable for applications requiring alternation between an overriding system (connected to CHO) and the digital and the analogue inputs. The active control location can be switched from the overriding system to I/O by using a digital input in REMOTE mode. See Parameter 10.07 **HAND/AUTO**.

**LOCAL Mode**

The local control mode is mainly used when commissioning and servicing. Local control is selected by the LOC/REM key on either the CDP 312 control panel or DriveWindow. The controls from the overriding system have no effect in this mode. Changing the control location to LOCAL can be disabled with Parameter **16.04 LOCAL LOCK**. Parameter values can always be monitored and changed regardless of the selected control mode.

**Emergency Stop**


ACS 600 MultiDrive hardware and System Application Program fulfils the following emergency stop category classes:

- Class 0 Immediate removal of power.
- Class 1 Controlled emergency stop.

See also **ACS 600 MultiDrive Safety and Product Information (Code 3AFY 63982229)**.

**Emergency Stop Hardware**

The Emergency stop signal is connected to digital input 1 (DI1) of the Basic I/O board (NIOC-01) or NDIO Extension module 1 and is activated by setting DI1 or Main Control Word (MCW) bit 2 to FALSE (0).
Chapter 3 – Software Description

The emergency stop feedback signal is sent through relay output RO1 of NIOC-01 or NDIO module 1 to the ACU (Auxiliary Control Unit) which contains the control relays for the common emergency stop circuit. The purpose of the feedback signal is to confirm that the emergency stop function has been received and the drive program is running. If no feedback is received, the main AC supply will be switched off by hardware after the short delay defined by the ACU (Auxiliary Control Unit) adjustable relays.

Note: When an emergency stop signal is detected, the emergency stop cannot be cancelled even though the signal is cancelled (emergency stop push button is released).

Torque Limit Ramping beginning of Emergency Stop

The maximum and minimum torque limits ramping to low value for a while can be used to guarantee smooth direction change of power with regenerative supply units. This function can be selected by Parameter 21.08 EM STOP TORQ RAMP.

Emergency Stop Modes

The emergency stop mode can be pre-selected by Parameter 21.04 EME STOP MODE. On an emergency stop, the torque selector is always set to position SPEED CONTROL except when in the FOLLOWER STOP mode.

Action if the Motor Is Stopped

The following actions are taken if the motor is already at zero speed when the drive receives an emergency stop signal.

- Run and magnetising of motor is prevented.
- Bit 5 is set to a 0 of the MAIN STATUS WORD (MCW)
- Bit 1 of ALARM WORD 1 (9.04) is set to 1.
- Relay output RO1 is energised until the MCW bit 0 is set to 0.

Action if the Motor Is Running

The following actions are taken if the motor is running when the drive receives an emergency stop signal.

- The drive is stopped according to the emergency stop mode Parameter EME STOP MODE (21.04).
- The application program locks the emergency stop procedure and energises the relay output1 until the motor has reached zero speed and the (MCW) MAIN CTRL WORD (7.01) bit 0 is set to “0” state.
• The application program supervises that the deceleration of the drive is within the window defined by Parameters 21.05 EMSTOP DER MIN L and 21.06 EMSTOP DER MAX L. This supervision starts according to 21.07 DECEL MON DELAY. If the drive is not able to decelerate the motor within the window, it is stopped by coasting and (ASW) AUX STATUS WORD (8.02) bit 2 (EMERG_STOP_COAST) is set to 1.

Prevention of Unexpected Start-Up


The function is realised by disconnecting the control voltage of the inverter power semiconductors. Thus it is not possible for the power semiconductors to switch and generate the AC voltage needed to rotate the motor.

WARNING! Prevention of unexpected start-up does not disconnect the voltage from the main and auxiliary circuits. Therefore, maintenance work on electrical parts can only be carried out after switching off the mains supply of the drive system.

The prevention of unexpected function operates as follows:

The operator activates the prevention of unexpected start-up with a switch mounted on the control desk. The drive application program diagnostics routine receives an internal signal from the NINT board that a prevention of unexpected start-up input has been detected. Then the voltage supply of the NGPS-0x board is disconnected. The program performs the following actions:

• Drive is stopped by coasting, if the function has been activated during run. This is at first hardware-controlled; the program only provides diagnostics at this point.

• Activates the alarm “START INHIBI” (start inhibition).

• ALARM WORD_1 (9.04) bit 0 is set to 1.

• AUXILIARY STATUS WORD (8.02) bit 8 is set to 1.

If a start command is given while the prevention of the unexpected start-up function is active, the fault “START INHIBI” is activated (start inhibition).
Communication

*DDCS Channels in NAMC CONTROLLERS*

In the following table there is described how the DDCS channels on the NAMC board is used.

The types of the optic components are also given (5 MBd or 10 MBd).

*Table 3 - 1 Usage and Type of DDCS Channels in NAMC Controllers.*

<table>
<thead>
<tr>
<th>CH No</th>
<th>STANDARD USAGE</th>
<th>NAMC-51 DDCS Communication Option</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ACS 600 MD</td>
<td>NAMC-51</td>
</tr>
<tr>
<td>CH0</td>
<td>- Applic. Controller</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>- Fieldbus Interface</td>
<td>-</td>
</tr>
<tr>
<td>CH1</td>
<td>- Basic I/O</td>
<td>5 MBd</td>
</tr>
<tr>
<td></td>
<td>- Optional I/O</td>
<td></td>
</tr>
<tr>
<td>CH2</td>
<td>- Master / Follower</td>
<td>-</td>
</tr>
<tr>
<td>CH3</td>
<td>- DriveWindow (PC, 1 Mbit/s)</td>
<td>-</td>
</tr>
</tbody>
</table>

Several communication protocols are supported by fieldbus adapters connected to DDCS channel 0 (CH0) on the NAMC board. The communication protocol of channels CH0...CH3 is DDCS (Distributed Drives Communication System). The NAMC-51 board CH0 supports either DriveBus or DDCS protocol. The Drivebus master can send one message that contains 1 data set for 10 drives during a 1 ms. The DDCS link between the overriding system and the drive uses data sets for the information exchange. The link sends the information of a transmitted data set to the data set table in the drive program and returns the content of the next data set to the overriding system as a “return message”. The data received from the overriding system affects only the RAM (not FPROM) memory on the NAMC board.

Fieldbus communication mainly uses data sets 1 and 2 between the fieldbus adapter and the NAMC board. Some of the adapters can transfer more data. For that purpose there is an offset parameter for the first transmitted data set in Parameter Group 51. For example, by setting the offset to 9, the first data set written to data set 10. Set parameter 71.01 CHO DRIVEBUS MODE off and reconnect the auxiliary power to NAMC-board.
Fieldbus Signals

Signal sources and targets have been fixed as shown in the table below. This mode is applied with selection **FBA DSET 1** for Parameter **98.02 COMM MODULE**. The signal updating interval is 10 ms.

Table 3 - 2 Fieldbus Signals

<table>
<thead>
<tr>
<th>Data Set</th>
<th>Index</th>
<th>Signal</th>
<th>Source or Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>index 1</td>
<td>MCW</td>
<td>7.01 MAIN CTRL WORD</td>
</tr>
<tr>
<td></td>
<td>index 2</td>
<td>REF1</td>
<td>23.01 SPEED REF in DTC or</td>
</tr>
<tr>
<td></td>
<td>index 3</td>
<td>REF2</td>
<td>29.01 FREQ REF in Scalar control</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>25.04 TORQUE REF B</td>
</tr>
<tr>
<td>2</td>
<td>index 1</td>
<td>MSW</td>
<td>8.01 MAIN STATUS WORD</td>
</tr>
<tr>
<td></td>
<td>index 2</td>
<td>ACT1</td>
<td>1.01 MOTOR SPEED FILT</td>
</tr>
<tr>
<td></td>
<td>index 3</td>
<td>ACT2</td>
<td>1.08 MOTOR TORQUE</td>
</tr>
</tbody>
</table>

Addressing of Data Using Data Sets 10...33

This mode is typically used when the overriding system is able to communicate using the DDCS protocol and there is a need to transfer several control signals and actual values. This is selected by setting Parameter **98.02 COMM MODULE** to **FBA DSET10**. Every data set has a specified read and write task interval in the drive program. See the sections "Received Data Set Table" and "Transmitted Data Set Table". Addresses are assigned in the drive according to Parameter Groups 90...93, not sent through the link except the last data sets 32 and 33 which are dedicated for "mail box" use.

The Mail Box Function

Individual parameter values can be read and set from the overriding system simply by using data sets 32 and 33. Parameter transmit and receive addresses and data for data sets 32 and 33 are defined in the Overriding System application. They can be used as a "mail box" for setting or inquiring parameter values.

Integer Scaling on the DDCS Link

Due to the effectiveness of the communication method, the data is transferred as integer values through the link. Therefore the actual and reference values have to be scaled to 16-bit integers for the DDCS link. The integer scaling factor is mentioned in the AMC table parameter list in the column Integer scaling.

<table>
<thead>
<tr>
<th>05</th>
<th>(161.3) CURRENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>Description: Measured motor current absolute value</td>
</tr>
<tr>
<td>Unit: A</td>
<td>Type: R</td>
</tr>
</tbody>
</table>
Chapter 3 – Software Description

Each parameter has two different gateways to write the value: integer format or decimal. Finally, the result is exactly same in the NAMC program. This relationship is always shown in the signal and parameter table as shown above.

Received Data Set Table

Data set target addresses are assigned by the CDP 312 control panel or DriveWindow into Parameters 90...93, or by means of transmit data set 32.

Addresses for Data Received from the Overriding System

<table>
<thead>
<tr>
<th>Data Set Number</th>
<th>Data Set Index</th>
<th>Interval NAMC-51</th>
<th>Default Address</th>
<th>Parameter Name (default values)</th>
<th>Address Set Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>1</td>
<td>2 ms</td>
<td>701</td>
<td>MAIN CTRL WORD</td>
<td>90.01</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2 ms</td>
<td>2301</td>
<td>SPEED REF</td>
<td>90.02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2 ms</td>
<td>2501</td>
<td>TORQ REF A</td>
<td>90.03</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>4 ms</td>
<td>702</td>
<td>AUX CTRL WORD</td>
<td>90.04</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4 ms</td>
<td></td>
<td></td>
<td>90.05</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4 ms</td>
<td></td>
<td></td>
<td>90.06</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>10 ms</td>
<td></td>
<td></td>
<td>90.07</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10 ms</td>
<td></td>
<td></td>
<td>90.08</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>10 ms</td>
<td></td>
<td></td>
<td>90.09</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>10 ms</td>
<td></td>
<td></td>
<td>90.10</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10 ms</td>
<td></td>
<td></td>
<td>90.11</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>10 ms</td>
<td></td>
<td></td>
<td>90.12</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>90.13</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>90.14</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>90.15</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>90.16</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>90.17</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>90.18</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>91.01</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>91.02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>91.03</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>91.04</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>91.05</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>91.06</td>
</tr>
<tr>
<td>26</td>
<td>1</td>
<td></td>
<td></td>
<td>Not in use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>Not in use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td>Not in use</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>1</td>
<td></td>
<td></td>
<td>Transmit address in NAMC program</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>Transmit data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td>Inquire address</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td></td>
<td></td>
<td>Transmit address in NAMC program</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>Transmit data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td>Inquire address</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>1</td>
<td>100 ms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>100 ms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>100 ms</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The given update times are the times within the drive is reading data from data sets to the AMC parameter table. Since the drive is a follower of the communication master, the actual communication cycle time depends on the communication cycle time of master.
Data set source addresses are set by the CDP 312 control panel or DriveWindow into Parameters 90...93, or by means of transmit data set 32.

<table>
<thead>
<tr>
<th>Transmitted Data Set Table</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Data Set Number</th>
<th>Data Set Index</th>
<th>Interval NAMC-51</th>
<th>Default Address</th>
<th>Parameter Name (default values)</th>
<th>Address Set Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>1</td>
<td>2 ms</td>
<td>801</td>
<td>MAIN STATUS WORD</td>
<td>92.01</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2 ms</td>
<td>102</td>
<td>SPEED MEASURED</td>
<td>92.02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2 ms</td>
<td>209</td>
<td>TORQUE REF 2</td>
<td>92.03</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>4 ms</td>
<td>802</td>
<td>AUX STATUS WORD</td>
<td>92.04</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4 ms</td>
<td>101</td>
<td>MOTOR SPEED</td>
<td>92.05</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4 ms</td>
<td>108</td>
<td>TORQUE</td>
<td>92.06</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>10 ms</td>
<td>901</td>
<td>FAULT WORD 1</td>
<td>92.07</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10 ms</td>
<td>902</td>
<td>FAULT WORD 2</td>
<td>92.08</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>10 ms</td>
<td>906</td>
<td>FAULT WORD 3</td>
<td>92.09</td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>10 ms</td>
<td>904</td>
<td>ALARM WORD 1</td>
<td>92.10</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10 ms</td>
<td>905</td>
<td>ALARM WORD 2</td>
<td>92.11</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>10 ms</td>
<td></td>
<td></td>
<td>92.12</td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td>100 ms</td>
<td>803</td>
<td>LIMIT WORD 1</td>
<td>92.13</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>100 ms</td>
<td>804</td>
<td>LIMIT WORD 2</td>
<td>92.14</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>92.15</td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>100 ms</td>
<td>111</td>
<td>TEMPERATURE (of heat sink)</td>
<td>92.16</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>100 ms</td>
<td>115</td>
<td>MOTOR MEAS TEMP</td>
<td>92.17</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>92.18</td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>93.01</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>93.02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>93.03</td>
</tr>
<tr>
<td>25</td>
<td>1</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>93.04</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>93.05</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>100 ms</td>
<td></td>
<td></td>
<td>93.06</td>
</tr>
<tr>
<td>27, 29, 31</td>
<td></td>
<td></td>
<td></td>
<td>Not in use</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>1</td>
<td>100 ms</td>
<td></td>
<td>Transmit address feedback</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>100 ms</td>
<td></td>
<td>Inquired data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>100 ms</td>
<td></td>
<td>Inquired address feedback</td>
<td></td>
</tr>
</tbody>
</table>

*Note:* The given update times are the times within the drive is writing data from the AMC parameter table to the data sets. Since the drive is a follower of the communication master, the actual communication cycle time depends on the communication cycle time of master.
The NPBA-02 PROFIBUS Adapter Module is compatible with the PROFIBUS-FMS and PROFIBUS-DP protocols. Configuration parameters of the module are set in Parameter Group 51. Note that the new settings take effect only when the module is powered up for the next time.

PPO type 5 supports 10 DW (16 bit) transmit and receive. See Parameter Groups 90...93 for information on assigning the data. The parameter service is also available (see parameter identification).

### PPO5 Messages

<table>
<thead>
<tr>
<th>Parameter Identification</th>
<th>Process Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data set 10 &amp; 11</td>
</tr>
<tr>
<td>ID</td>
<td>IND</td>
</tr>
<tr>
<td>----</td>
<td>-----</td>
</tr>
</tbody>
</table>

Set: (51.02) PROFIBUS MODE  DP-PPO5
(51.03) STATION NUMBER  According to configuration of the PROFIBUS Master device
(51.05) NO. OF DATA SETS  4
(51.06) DATA SET OFFSET  9
(70.01) CH0 NODE ADDR  1
(70.03) BAUD RATE  4 Mbit/s
(51.08) COMM PROFILE  ABB DRIVES
(98.02) COMM MODULE  FBA DSET10
(71.01) CH0 DRIVEBUS MODE  NO

Figure 3 - 4 PROFIBUS configuration example using NPBA-02 adapter module to transfer 10 words between the drive and the overriding system in both directions.

See the chapter Programming in the Installation and Start-up Guide for PROFIBUS Adapter Module NPBA-12 (Code 3BFE 64341588) or NPBA-02 (Code 3AFY 58995789).

In addition to Process Data, parameters can be read and written using the protocol types PPO1, PPO2 and PPO5. See the chapter Communication in the Installation and Start-up Guide for PROFIBUS Adapter Module NPBA-12 (Code 3BFE 64341588) or NPBA-02 (Code 3AFY 58995789).

With the formulas below you can calculate the Profibus parameter numbers (25 parameters / group) for the ACS 600 parameter groups 10...51:

The groups 10...51 and 98...99 have 25 parameters per group. Profibus parameter number is calculated as follows:

**Profibus parameter = 25 * (Group no. - Offset + (Index/25))**

The offset has the following values:

- Group no. 10 to 41  => Offset = 6
- Group no. 50 to 51  => Offset = 10
- Group no. 98 to 99  => Offset = 22
The groups 52...97 have 18 parameters per group instead of 25. Profibus parameter number is calculated as follows:

**Profibus parameter = 1050 + (Group no. - 52) * 18 + Index no.**

The signals in the groups 1 to 3 are translated into Profibus parameters as follows:

- Group no.1: parameter no. 1 to 50=> Profibus parameter no. 1 to 50
- Group no.2: parameter no. 1 to 25=> Profibus parameter no. 51 to 75
- Group no.3: parameter no. 1 to 25=> Profibus parameter no. 76 to 100

Example: Parameter 22.01 ACCELER TIME corresponds to PROFIBUS address

\[
\text{ADDR}_{16} = 25 \times (22 - 6 + (1/25)) = 401_{10} = 191_{16}
\]

(Add 4000 in FMS Mode)

**I/O Devices on Channel CH1**

All of the drive I/O devices are connected in a ring to channel 1 (CH1) on the NAMC board. The NAMC is the master in the communication link. Each device has an individual address, set with DIP switches on the device. Before use, each I/O device must be activated from Parameter Group 98.

**Master/Follower Link on Channel CH2**

A Master/Follower link can be formed by connecting the CH2 channels of two or more drives in a ring. Parameters 70.07 to 70.14 define the mode and the references. The message type is broadcast.

**Commissioning and Supporting Tools on Channel CH3**

The DriveWindow commissioning and other tools can be connected to channel CH3 on the NAMC board, either in a ring, or a star connection using NDBU-xx branching boards. Node numbers must be set for each drive unit before starting the communication through the connection: see Parameter **70.15 CH3 NODE ADDR**. This setting can be made by a point to point connection with either the control panel CDP 312 or DriveWindow. The new node address becomes valid after auxiliary power shutdown of the NAMC-board. The NAMC-board channel 3 (CH3) has been configured to Slave in the communication point of view.

**Modbus Link**

The CDP 312 Control Panel, NLMD-01 Led Monitoring Display panel or DriveWindow can be connected to the ACS 600 drive through a Modbus link. The communication speed is 9600 bit/s (8 data bits, 1 stop bit, odd parity). The connected device is the master of the communication link. An NBCI-01 bus connection units must be used if the distance between the panel and drive is over three metres.
Modbus is designed for integration with Modicon PLCs or other automation devices, and the services closely correspond to the PLC architecture. The ACS 600 drive looks like a Modicon PLC on the network.

The ACS 600 drive parameter and data set information is mapped into the 4xxxx register area. This holding register area can be read from an external device, which can modify the register values by writing to them.

There are no setup parameters for mapping the data to the 4xxxx registers. The mapping is pre-defined and corresponds directly to the drive parameter grouping which is being used by the local drive panel.

All parameters are available for both reading and writing. The parameter writes are verified for correct value and for valid register addresses. Some parameters never allow write access (including actual values), some parameters allow write access only when the drive is stopped (including setup variables), and some parameters can be modified at any time (including actual reference values).

The drive parameters are mapped to the 4xxxx area so that: 40101 – 40999 registers are reserved for the signal values 41000 – 49999 registers are reserved for the parameter data

In this mapping, the thousands and hundreds correspond to the group number, while the tens and ones correspond to the parameter number within a group.
Digital input DI2 is also used in the R2i...R6i inverter frames to indicate the position of the DC switch (optional) to the charging logic.

Three conditions must be fulfilled before the charging relay can be energised: DC voltage level or DC voltage, derivative = 0, DI2 = 1.

When the DC switch is opened, control pulses of the inverter are blocked as in the RUN ENABLE function and the charging relay is opened. In case of undervoltage in the supply, the charging relay opens after the undervoltage trip.

**ABB Drive Profile**

**Drive States**

The ABB Drive Profile is a PROFIBUS-based model to describe the drive interface between the state transitions under control of an overriding control system. In order to achieve this, the ABB Drive Profile defines general states. A control word generally commands transitions between these states. The table below gives an interpretation for the most important states and also the ABB names for these states.
Table 3 - 3 ABB Drive Profile States, see Chapter 4 – Signals for more Information on Status and Commands.

<table>
<thead>
<tr>
<th>Action</th>
<th>Name of state</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch on inhibit</td>
<td>ON_INHIBIT</td>
<td>The drive is moved to this state after the EMERGENCY OFF/STOP or TRIPPED state. The main idea is to guarantee that the ON command is removed. Drive is moved to an OFF -state after the ON command has been removed.</td>
</tr>
<tr>
<td>Not ready for switch on</td>
<td>OFF</td>
<td>The drive stays in this state as long as the EMERGENCY OFF/STOP commands are active. After these commands have been deactivated and the command “Control from the automation unit” is activated, the drive is moved to the RDYON state.</td>
</tr>
<tr>
<td>Ready to switch on</td>
<td>RDY_ON</td>
<td>After an “ON” command the drive is allowed to perform equipment specific actions. For drives these are:</td>
</tr>
<tr>
<td>Ready</td>
<td>RDY_RUN</td>
<td>After a “RUN” command the drive performs:</td>
</tr>
<tr>
<td>Enable operation</td>
<td>RDY_REF</td>
<td>The drive is following the given references.</td>
</tr>
<tr>
<td>RFG: enable output</td>
<td></td>
<td>This is actually the speed ramp control, all drive controllers are activated but the output of the speed ramp is clamped to zero.</td>
</tr>
<tr>
<td>Operating status</td>
<td></td>
<td>This is also the speed ramp control, the input of ramp is released.</td>
</tr>
<tr>
<td>OFF 1 active</td>
<td></td>
<td>The ON command is removed. The drive deactivates all of its functions which were commanded by the ON command e.g. Drive is first decelerated to the zero speed by emergency stop ramp.</td>
</tr>
<tr>
<td>OFF 2 active</td>
<td>OFF_2_STA EMERGENCY OFF</td>
<td>After this the drive is shifted to the OFF-state.</td>
</tr>
<tr>
<td>OFF 3 active</td>
<td>OFF_3_STA EMERGENCY STOP</td>
<td>The voltage of the drive is immediately removed (coast stop), all functions created by the ON command are removed and after that the drive is shifted to ON INHIBIT state.</td>
</tr>
<tr>
<td>Fault</td>
<td>TRIPPED</td>
<td>The drive is decelerated to zero speed according to the parameter 21.04 EME STOP MODE, all of the functions created by the ON command are removed and after that the drive is shifted to the ON INHIBIT state.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After tripping the drive remains in this state as long as the rising edge of the RESET-signal is sent to the drive. The drive is shifted to the ON INHIBIT state, so the ON command must first be turned OFF before the sequence is allowed to continue.</td>
</tr>
</tbody>
</table>
Main Control Word (MCW)

The table below defines the use of the ABB Drive Profile command word for drives application.

Table 3 - 4 Main Control Word Bits 0 to 7, see Chapter 4 – Signals for more Information on Status and Commands.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ON</td>
<td>1</td>
<td>Command to “RDYRUN” state.</td>
</tr>
<tr>
<td></td>
<td>OFF1</td>
<td>0</td>
<td>Command to “OFF” state. (Can go immediately to “RDYON” -state if there are no other interlockings (OFF 2 / OFF 3). Drive stops down to the zero speed by ramp. Ramp time is defined by parameter 22.04 EME STOP RAMP. All pulses are removed, when in zero speed. Restart is not possible before zero speed.</td>
</tr>
<tr>
<td>1</td>
<td>OFF 2</td>
<td>1</td>
<td>No OFF 2 (Emergency OFF)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>Command to “ON INHIBIT” state. Inhibit pulses and drive coasts down. Sequence control handles: - Stator and flux current to zero - All pulses are removed</td>
</tr>
<tr>
<td>2</td>
<td>OFF 3</td>
<td>1</td>
<td>No OFF 3 (Emergency STOP)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>Command to “ON INHIBIT” state. Digital input 1 in the hardware operates parallel with this bit. Fast stop: The fastest possible deceleration, by current limit, fast ramp or coast stop. Defined in the parameter 21.04 EME STOP MODE. After zero speed the sequence control handles: - Stator and flux current to zero - All pulses are removed</td>
</tr>
<tr>
<td>3</td>
<td>RUN</td>
<td>1</td>
<td>Enable Operation Command to RDYREF -states. Enable stator/armature pulses. Raise flux to the nominal reference if not already in that value. Then accelerate via speed ramp to the given speed reference setpoint.</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>Inhibit Operation. Inhibit inverter pulses and the drive coasts, and goes into the “READY” status (refer to control word bit 0)</td>
</tr>
<tr>
<td>4</td>
<td>RAMP-OUT-ZERO</td>
<td>1</td>
<td>Operating condition.</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>Ramp-function generator output is set to zero. Drive ramps down along the current limit or at the DC-link voltage limit.</td>
</tr>
<tr>
<td>5</td>
<td>RAMP-HOLD</td>
<td>1</td>
<td>Enable ramp-function generator.</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>Speed ramping stopped. Freeze the actual setpoint from the ramp-function generator.</td>
</tr>
<tr>
<td>6</td>
<td>RAMP-IN-ZERO</td>
<td>1</td>
<td>Enable setpoint</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>Inhibit setpoint. Speed ramp input is forced to zero.</td>
</tr>
<tr>
<td>7</td>
<td>RESET</td>
<td>1</td>
<td>Fault resetting with a positive edge.</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>No significance</td>
</tr>
</tbody>
</table>
Table 3 - 5 COMMAND WORD Bits 8 to 10 meaning, see Chapter 4 – Signals for more Information on Status and Commands.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
</table>
| 8   | INCHING_1     | 1     | Drive accelerates as fast as possible to inching setpoint 1, if following conditions are fulfilled:  
- bit RAMP-OUT-ZERO = 0  
- bit RAMP-HOLD = 0  
- bit RAMP-IN-ZERO = 0  
0 | Drive brakes as fast as possible if INCHING_1 was previously ON |
| 9   | INCHING_2     | 1     | Drive accelerates as fast as possible to inching setpoint 2, if following conditions are fulfilled:  
- bit RAMP-OUT-ZERO = 0  
- bit RAMP-HOLD = 0  
- bit RAMP-IN-ZERO = 0  
0 | Drive brakes as fast as possible if INCHING_1 was previously ON |
| 10  | REMOTE_CMD    | 1     | Overriding computer is requesting to control the drive |
|     |               | 0     | No control from the overriding system, except OFF1, OFF2 and OFF3 commands. |
Chapter 3 – Software Description

ABB Drive Profile for AC-drives
Control and States

Figure 3 - 6 Control and State Diagram, see Chapter 4 – Signals for more Information on Status and Commands.
Figure 3 - 7 Control example: Start by AUTO or DC MAGN Mode, Stop by Ramp Generator, see Chapter 4 – Signals for more Information on Status and Commands.
FLUX ON, START, STOP by Torque Limit, FLUX ON

**Figure 3 - 8 Control example:** Start by FLUX ON DC Command, Stop by Torque Limit, see Chapter 4 – Signals for more Information on Status and Commands.
FAULT, RESET, INCHING 1, INCHING 2, RUN by SPEED REF

Control by Overriding System

MCW 7.01 bits

Par. 50.10 ABOVE_SPEED_LIMIT
Par. 23.02 CONST SPEED1
Par. 20.03 ZERO_SPEED_LIMIT
Par. 23.03 CONST SPEED2

0 ON_OFF1
1 OFF2
2 OFF3
3 RUN
4 RAMP_OUT_ZERO
5 RAMP_HOLD
6 RAMP_IN_ZERO
7 RESET
8 INCHING1
9 INCHING2
10 REMOTE_CMD

MSW 8.01 bits

0 RDY ON
1 RDY RUN
2 RDY REF
3 TRIPPED
4 OFF_2_STA
5 OFF_3_STA
6 ON_INHIBITED
7 ALARM
8 AT_SETPOINT
9 REMOTE
10 ABOVE_LIMIT

ACW 7.02 bits

0 RAMP_BYPASS
1
2 BAL_RAMP_OUT
3 FLUX_ON_DC
4 FLUX_ON
5
6
7

ASW 8.02 bits

0
1
2
3 MAGNETIZED
...
...
11 ZERO_SPEED

Figure 3 - 9 Control example: Fault Reset, Run by CONST SPEED 1 (Inching 1), CONST SPEED 2 (Inching 2) and SPEED REF, see Chapter 4 – Signals for more Information on Status and Commands.
Figure 3-10 Control example: Emergency Stop with Ramp (OFF3) and AUTO RESTART after the Short Supply Power Failure, see Chapter 4 – Signals for more Information on Status and Commands.
Chapter 3 – Software Description

I/O Configurations

**Digital Inputs**

All the inputs can be read by the overriding controller. See signals DI6-1 STATUS (1.15) and DI STATUS WORD (8.05). Input functions are programmable and defined in parameter group 10.

The basic I/O board NIOC-01, NIOB-01 or NBIO-21 can be selected by parameter **98.07 BASIC I/O BOARD**.

The hardware source is selected by Parameters 98.03...98.05 and 98.07. There are five selections available:

1. NIOC-01 basic I/O board.
2. NBIO-21 I/O Unit as the basic I/O board.
3. NIOB-01 I/O Unit as the basic I/O board.
4. NDIO I/O Extension modules replace basic I/O board inputs.
5. NDIO I/O Extension modules extend the I/O.

The maximum number of digital inputs is 12.

<table>
<thead>
<tr>
<th>Software</th>
<th>NIOC-01 I/O Board</th>
<th>NDIO I/O</th>
<th>Parameter Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O Name</td>
<td>DI1</td>
<td>DI2</td>
<td>DI3</td>
</tr>
<tr>
<td>DI1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>DI2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>DI3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>DI4 *)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>DI5 *)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>DI6 *)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>EXT1_DI1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>EXT1_DI2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>EXT2_DI1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>EXT2_DI2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>EXT3_DI1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>EXT3_DI2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*) Not available with NBIO-21 and NIOB-01 I/O Unit

**Hardware Source Selection for Digital Inputs**

**Digital Outputs**

The following digital outputs are available in the AMC program. The outputs are programmable (see Parameter Group 14) and can also be controlled from the overriding system.

The use of DO2 and DO3 control upon a communication break can be defined by Parameter **21.07 COM LOSS RO**.

Digital outputs can also be controlled from the overriding system by means of Auxiliary Control Words 7.01 and 7.02.
The hardware source is selected by Parameters 98.03...98.05 and 98.07. There are five selections available:

1. NIOC-01 basic I/O board.
2. NBIO-21 I/O Unit as the basic I/O board.
3. NIOB-01 I/O Unit as the basic I/O board.
4. NDIO I/O Extension modules replace basic I/O board digital outputs and add EXT2.DO2, EXT3.DO1 and EXT3.DO2.
5. NDIO I/O Extension modules extend the I/O. The maximum numbers of digital inputs and outputs are 12 and 9 respectively. EXT2.DO1 and EXT2.DO2 can also be programmed from the group 14.

<table>
<thead>
<tr>
<th>Software</th>
<th>NIOC-01 I/O Board</th>
<th>NDIO I/O</th>
<th>Parameter Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O Name</td>
<td>DO1</td>
<td>DO2</td>
<td>DO3</td>
</tr>
<tr>
<td>DO1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>DO2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>DO3 *)</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>EXT1.DO1</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>EXT1.DO2</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>EXT2.DO1</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>EXT2.DO2</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>EXT3.DO1</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>EXT3.DO2</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

*) Not available with NBIO-21 and NIOB-01 I/O Unit

**Analogue Inputs**

Analogue inputs can be used for motor temperature measurement, I/O speed / torque references and signals can be read by the overriding system.

**I/O Speed Reference**

If a bipolar type of analogue input is needed, the scaling to the speed units (integer value –20000...0...20000) is defined by Parameters ALIx HIGH VALUE and ALIx LOW VALUE. The digital input function DIRECTION is valid only with unipolar signals. See parameter MINIMUM AI1 in Group 13.

Example:

Bipolar type of speed reference signal is needed. Range is –10V..0...+10V. Set 13.01 AI1 HIGH VALUE to 20000 and 13.02 AI1 LOW VALUE to –20000. Select –10V with 13.12 MINIMUM AI1. 20000 units equals the speed in Parameter 50.01 SPEED SCALING.
Chapter 3 – Software Description

### NIOC-01 Basic I/O Board

Three differential non-galvanically isolated analogue inputs (10 bits, accuracy +/- 0.5 %) are available on the basic (NIOC-01) I/O board. The updating interval is 10 ms for the speed reference chain. The overriding system can read the inputs if the motor temperature measurement is not selected.

<table>
<thead>
<tr>
<th>NIOC-01</th>
<th>Input Type</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC I/O board</td>
<td>AI 1</td>
<td>0 ... 10V DC, $R_i = 200 , \text{k}\Omega$</td>
<td>MOTOR 1 _TEMP or SPEED REFERENCE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Motor temperature measurement by means of 1...3 PTC thermistor or 1...3 PT100 sensors. Speed reference if I/O control or HAND/AUTO selected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>If both functions have been incorrectly selected to the AI1, MOTOR1 TEMP is valid, speed reference is switched to zero and an alarm &quot;I/O SP REF&quot; is indicated.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NIOC-01</th>
<th>Input Type</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC I/O board</td>
<td>AI 2</td>
<td>0(4) ... 20 mA, $R_i = 100 , \Omega$</td>
<td>SPEED REFERENCE or not used</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Alternative for speed reference (mA) if I/O control control or HAND/AUTO is selected.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NIOC-01</th>
<th>Input Type</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC I/O board</td>
<td>AI 3</td>
<td>0(4) ... 20 mA, $R_i = 100 , \Omega$</td>
<td>TORQUE REFERENCE or not used</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Torque reference, if I/O control control or HAND/AUTO is selected.</td>
</tr>
</tbody>
</table>

### NBIO-21/NIOB-01 Analogue Inputs

Two bipolar 12 bit + sign analogue inputs are available on the NBIO-21 and NIOB-01 I/O Unit. The hardware range ($-2V...0...+2V$ or $-10V...0...+10V$) is selected by parameters 13.13 NBIO/NIOB Al1 GAIN and 13.14 NBIO/NIOB Al2 GAIN. Voltage / current type input is selected separately for both channels with switch S2. The node address is A and selected with switch S1.

<table>
<thead>
<tr>
<th>NBIO-21/NIOB-01</th>
<th>Input Type</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIPOLAR MODE</td>
<td>Al1</td>
<td>MOTOR 1 TEMP or SPEED REFERENCE</td>
<td>Motor 1 temperature measurement by means of 1...3 PTC thermistors or PT100 sensors or Speed reference of the drive in the I/O-control mode</td>
</tr>
<tr>
<td></td>
<td>Al2</td>
<td>MOTOR 2 TEMP or TORQUE REFERENCE B</td>
<td>Motor 2 temperature measurement by means of 1...3 PTC thermistors or PT100 sensors. Bipolar torque reference in the I/O control mode.</td>
</tr>
</tbody>
</table>
It is possible to use an NAIO-03 Analogue I/O Extension Module to replace inputs AI1, AI2 and outputs AO1 and AO2 on the NIOC-01 Basic I/O board. The resolution of the NAIO-03 is 12 bits. The input range is selectable by DIP switches and the maximum voltage or milliampere value corresponds an integer value in the software, defined by parameter $\text{AI}x \text{ HIGH VALUE}$ in the group 13. The module selection is done by Parameter 98.06.

### NAIO-03 Analogue I/O Extension Module

#### UNIPOLAR MODE (NAIO-01 mode)

<table>
<thead>
<tr>
<th>Module</th>
<th>Input Type</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI/O Extension module 1 AI1</td>
<td>0(4) ... 20 mA</td>
<td>MOTOR 1 TEMP</td>
<td>Motor 1 temperature measurement by means of 1...3 PTC thermistors or PT100 sensors or Speed reference of the drive in the I/O-control mode</td>
</tr>
<tr>
<td></td>
<td>$R_i = 100 , \Omega$</td>
<td>or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$0 \ldots 2 , V , DC$</td>
<td>SPEED</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$0 \ldots 10V , DC$</td>
<td>REFERENCE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$R_i = 200 , k\Omega$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### BIPOLAR MODE (NAIO-02 mode)

<table>
<thead>
<tr>
<th>Module</th>
<th>Input Type</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI/O Extension module 1 AI1</td>
<td>-20 ... 0 ... +20 mA</td>
<td>MOTOR 1 TEMP</td>
<td>Motor 1 temperature measurement by means of 1...3 PTC thermistors or PT100 sensors or Speed reference of the drive in the I/O-control mode</td>
</tr>
<tr>
<td></td>
<td>0(4) ... 20 mA</td>
<td>or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$0 \ldots 2 , V , DC$</td>
<td>SPEED</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$-10 \ldots 0 \ldots 10 , V , DC$</td>
<td>REFERENCE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$R_i = 200 , k\Omega$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Figure 3 - 11 Resolution of the A/D Converter as a Function of the Input Voltage

![A/D converter 12 bit resolution](image-url)
Chapter 3 – Software Description

**Analogue Outputs**

Two non-galvanically isolated analogue outputs (10 bits, accuracy +/-1%) are available on the basic I/O board (NIOC-01). The output updating time is 10 ms.

<table>
<thead>
<tr>
<th>NIOC-01</th>
<th>Output Type</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC I/O Board AO 1</td>
<td>0(4)...20 mA $R_i = 700 \Omega$</td>
<td>AO1_OUT</td>
<td>A programmable analogue output from the program. The output can be used also as a constant current source to supply the temperature measurement sensor PT100 or PTC. The current is set automatically according to the type of the sensor.</td>
</tr>
<tr>
<td>BASIC I/O Board AO 2</td>
<td>0(4)...20 mA $R_i = 700 \Omega$</td>
<td>AO2_OUT</td>
<td>(The overriding system application can control the output)</td>
</tr>
</tbody>
</table>

If an extension module is used, the resolution is 12 bits. Programmable analogue outputs can be extended using this module. See the different configurations at Parameter 98.06.

<table>
<thead>
<tr>
<th>NAIO-03</th>
<th>I/O Type</th>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al/I Extension Module 1 AO3</td>
<td>0(4)...20 mA $R_i = 700 \Omega$ Isolated from power supply</td>
<td>AO3_OUT</td>
<td>See Parameter 98.06 and Group 15</td>
</tr>
<tr>
<td>Al/I Extension Module 1 AO4</td>
<td>0(4)...20 mA $R_i = 700 \Omega$ Isolated from power supply</td>
<td>AO4_OUT</td>
<td>See Parameter 98.06 and Group 15</td>
</tr>
</tbody>
</table>

The NBIO-21 or NIOB-01 I/O Unit can be configured for unipolar 0...20 mA mode with a resolution of 12 bits, or bipolar –10V…0…+10 V mode with a resolution of 11 bits + sign.

<table>
<thead>
<tr>
<th>NBIO-21/ NIOB-01</th>
<th>I/O Type</th>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AO1</td>
<td>Voltage output – 10V…0…+10V 1 kΩ min or Current Output 0...20 mA Max load = 800 Ω Isolated from power supply</td>
<td>AO1_OUT</td>
<td>See Parameter 98.07 and Group 15</td>
</tr>
<tr>
<td>AO2</td>
<td>Voltage output – 10V…0…+10V 1 kΩ min or Current Output 0...20 mA Max load = 800 Ω Isolated from power supply</td>
<td>AO2_OUT</td>
<td>See Parameter 98.07 and Group 15</td>
</tr>
</tbody>
</table>
### Terminal Block X21

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VREF</td>
<td>Reference voltage +10 V DC</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>1 k...10 k ohm max. 10 mA</td>
</tr>
<tr>
<td>3</td>
<td>A1+</td>
<td>Analogue Input 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motor temperature measurement 0...10 V</td>
</tr>
<tr>
<td>4</td>
<td>A1-</td>
<td>Analogue Input 2</td>
</tr>
<tr>
<td>5</td>
<td>A2+</td>
<td>Analogue Input 3</td>
</tr>
<tr>
<td>6</td>
<td>A2-</td>
<td>Analogue Input 3</td>
</tr>
<tr>
<td>7</td>
<td>A3+</td>
<td>Analogue Input 3</td>
</tr>
<tr>
<td>8</td>
<td>A3-</td>
<td>Analogue Input 3</td>
</tr>
<tr>
<td>9</td>
<td>AO1+</td>
<td>Analogue Output 1</td>
</tr>
<tr>
<td>10</td>
<td>AO1-</td>
<td>Motor Torque</td>
</tr>
<tr>
<td>11</td>
<td>AO2+</td>
<td>Analogue Output 2</td>
</tr>
<tr>
<td>12</td>
<td>AO2-</td>
<td>Motor Speed</td>
</tr>
</tbody>
</table>

### Terminal Block X22

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D11</td>
</tr>
<tr>
<td>2</td>
<td>D12</td>
</tr>
<tr>
<td>3</td>
<td>D13</td>
</tr>
<tr>
<td>4</td>
<td>D14</td>
</tr>
<tr>
<td>5</td>
<td>D15</td>
</tr>
<tr>
<td>6</td>
<td>D16</td>
</tr>
<tr>
<td>7</td>
<td>+24 V DC</td>
</tr>
<tr>
<td>8</td>
<td>+24 V DC</td>
</tr>
<tr>
<td>9</td>
<td>DGND</td>
</tr>
</tbody>
</table>

### Terminal Block X23

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24 V DC</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
</tr>
</tbody>
</table>

### Terminal Block X25

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RO11</td>
</tr>
<tr>
<td>2</td>
<td>RO12</td>
</tr>
</tbody>
</table>

### Terminal Block X26

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RO21</td>
</tr>
<tr>
<td>2</td>
<td>RO22</td>
</tr>
</tbody>
</table>

### Terminal Block X27

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RO31</td>
</tr>
<tr>
<td>2</td>
<td>RO32</td>
</tr>
</tbody>
</table>

Figure 3 - 12 NIOC-01 I/O Board Default Signals when the Drive is Controlled through the Communication Link (Parameter 98.02 is set to FBA DSET 1 or FBA DSET 10)
### Chapter 3 – Software Description

#### Terminal Block X21

<table>
<thead>
<tr>
<th>Terminal Block X21</th>
<th>NIOC-01 I/O Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VREF</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>A1I+</td>
</tr>
<tr>
<td>4</td>
<td>A1I-</td>
</tr>
<tr>
<td>5</td>
<td>A2I+</td>
</tr>
<tr>
<td>6</td>
<td>A2I-</td>
</tr>
<tr>
<td>7</td>
<td>A3I+</td>
</tr>
<tr>
<td>8</td>
<td>A3I-</td>
</tr>
<tr>
<td>9</td>
<td>AO1+</td>
</tr>
<tr>
<td>10</td>
<td>AO1-</td>
</tr>
<tr>
<td>11</td>
<td>AO2+</td>
</tr>
<tr>
<td>12</td>
<td>AO2-</td>
</tr>
</tbody>
</table>

- **1** Function according to the parameter selection
- **2** If par. 30.03 = 1..3xPT100 or PTC
- **3** Motor Fan Control
  - Fan on: DO3
  - Acknowledge: Selectable DI3...DI6, EXT2_D11 or EXT2_D12
  - See par. group 10 and 35
- **4** See par. group 10 for Start/Stop/Direction.

#### Terminal Block X22

<table>
<thead>
<tr>
<th>Terminal Block X22</th>
<th>NIOC-01 I/O Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DI1</td>
</tr>
<tr>
<td>2</td>
<td>DI2</td>
</tr>
<tr>
<td>3</td>
<td>DI3</td>
</tr>
<tr>
<td>4</td>
<td>DI4</td>
</tr>
<tr>
<td>5</td>
<td>DI5</td>
</tr>
<tr>
<td>6</td>
<td>DI6</td>
</tr>
<tr>
<td>7</td>
<td>+24 V DC</td>
</tr>
<tr>
<td>8</td>
<td>+24 V DC</td>
</tr>
<tr>
<td>9</td>
<td>DGND</td>
</tr>
</tbody>
</table>

- **1** No Emergency Stop
- **2** Run Enable
- **3** Start Inhibit
- **4**
- **5** Reset
- **6**
- **7** +24 V DC
- **8** +24 V DC
- **9** Digital Ground

#### Terminal Block X23

<table>
<thead>
<tr>
<th>Terminal Block X23</th>
<th>NIOC-01 I/O Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24 V DC</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
</tr>
</tbody>
</table>

- **1** Aux. voltage output 24 V DC, 250 mA or 130 mA if NLMD-01 option included
- **2**

#### Terminal Block X25

<table>
<thead>
<tr>
<th>Terminal Block X25</th>
<th>NIOC-01 I/O Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RO11</td>
</tr>
<tr>
<td>2</td>
<td>RO12</td>
</tr>
<tr>
<td>3</td>
<td>RO13</td>
</tr>
</tbody>
</table>

- **1** Relay output 1
- **2**
- **3** Emergency

#### Terminal Block X26

<table>
<thead>
<tr>
<th>Terminal Block X26</th>
<th>NIOC-01 I/O Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RO21</td>
</tr>
<tr>
<td>2</td>
<td>RO22</td>
</tr>
<tr>
<td>3</td>
<td>RO23</td>
</tr>
</tbody>
</table>

- **1** Relay output 2
- **2** Run (default)

#### Terminal Block X27

<table>
<thead>
<tr>
<th>Terminal Block X27</th>
<th>NIOC-01 I/O Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RO31</td>
</tr>
<tr>
<td>2</td>
<td>RO32</td>
</tr>
<tr>
<td>3</td>
<td>RO33</td>
</tr>
</tbody>
</table>

- **1** Relay output 3
- **2**
- **3** Fault (default)

---

**Figure 3 - 13 NIOC-01 I/O Board Default Signals when the Drive is Controlled from the I/O (Parameter 98.02 COMM MODULE is set to NO or in HAND/AUTO mode)**
### NIOB-01 Basic I/O Board Connections

Terminal Block Size:
0.5 to 2.5 mm² (20 to 14 AWG)

#### Terminal Block X16

<table>
<thead>
<tr>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A11+</td>
</tr>
<tr>
<td>2</td>
<td>A11-</td>
</tr>
<tr>
<td>3</td>
<td>A12+</td>
</tr>
<tr>
<td>4</td>
<td>A12-</td>
</tr>
<tr>
<td>5</td>
<td>AO1U</td>
</tr>
<tr>
<td>6</td>
<td>AO1I</td>
</tr>
<tr>
<td>7</td>
<td>AO1C</td>
</tr>
<tr>
<td>8</td>
<td>AO2U</td>
</tr>
<tr>
<td>9</td>
<td>AO2I</td>
</tr>
<tr>
<td>10</td>
<td>AO2C</td>
</tr>
</tbody>
</table>

#### Terminal Block X15

<table>
<thead>
<tr>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EA+</td>
</tr>
<tr>
<td>2</td>
<td>EA-</td>
</tr>
<tr>
<td>3</td>
<td>EB+</td>
</tr>
<tr>
<td>4</td>
<td>EB-</td>
</tr>
<tr>
<td>5</td>
<td>EZ+</td>
</tr>
<tr>
<td>6</td>
<td>EZ-</td>
</tr>
<tr>
<td>7</td>
<td>+24VE</td>
</tr>
<tr>
<td>8</td>
<td>+15VE</td>
</tr>
<tr>
<td>9</td>
<td>0VE</td>
</tr>
<tr>
<td>10</td>
<td>0VE</td>
</tr>
</tbody>
</table>

#### Terminal Block X13

<table>
<thead>
<tr>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24V</td>
</tr>
<tr>
<td>2</td>
<td>0V</td>
</tr>
<tr>
<td>3</td>
<td>24V</td>
</tr>
<tr>
<td>4</td>
<td>0V</td>
</tr>
</tbody>
</table>

#### Terminal Block X12

<table>
<thead>
<tr>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DI1A</td>
</tr>
<tr>
<td>2</td>
<td>DI1A</td>
</tr>
<tr>
<td>3</td>
<td>DI1B</td>
</tr>
<tr>
<td>4</td>
<td>DI1B</td>
</tr>
<tr>
<td>5</td>
<td>Not in use</td>
</tr>
<tr>
<td>6</td>
<td>DI2A</td>
</tr>
<tr>
<td>7</td>
<td>DI2B</td>
</tr>
<tr>
<td>8</td>
<td>Not in use</td>
</tr>
<tr>
<td>9</td>
<td>DI3A</td>
</tr>
<tr>
<td>10</td>
<td>DI3B</td>
</tr>
</tbody>
</table>

#### Terminal Block X11

<table>
<thead>
<tr>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RO1C</td>
</tr>
<tr>
<td>2</td>
<td>RO1NO</td>
</tr>
<tr>
<td>3</td>
<td>Not in use</td>
</tr>
<tr>
<td>4</td>
<td>RO2C</td>
</tr>
<tr>
<td>5</td>
<td>RO2NO</td>
</tr>
</tbody>
</table>

**Figure 3 - 14 NIOB-01 I/O Unit Terminal Connections.**
### NBIO-21 I/O Unit

<table>
<thead>
<tr>
<th>Terminal Block X1</th>
<th>Description</th>
</tr>
</thead>
</table>
| B1, B2, A1, A2 | Power Supply Input  
24 V DC, ± 10%  
215 mA Typ., 250 mA Max |
| B3, A1+ | A11 Speed Ref or Motor 1 Temp  
± 20 mA, ± 2 V or ± 10 V |
| B4, A1- |  |
| A3, A2+ | A12 Torque Ref B / Motor 2 Temp  
± 20 mA, ± 2 V or ± 10 V |
| A4, A2- |  |
| B5, A0U | Analog Output 1 Motor Torque  
0 (4) ... 20 mA or ± 10 V |
| B6, A0I | Analog Output 2 Motor Speed  
0 (4) ... 20 mA or ± 10 V |
| B7, A0C |  |
| B9, B10, A9, A10 | Digital Input 1 No Emergency Stop  
24 V DC or 115/230 V AC |
| B12, D2A, D2B, A12 | Digital Input 2 Run Enable  
24 V DC or 115/230 V AC |
| B14, D3A, D3B, A14 | Digital Input 3 Start Inhibit  
24 V DC or 115/230 V AC |
| B16, RO1NO, 2.5 A, 2.5 A | Digital Output 1 Emergency Stop Acknowledgement  
Max 250 V AC or DC, 2 A AC, 18 W DC |
| A16, RO1C |  |
| B18, RO2NO, 2.5 A, 2.5 A | Digital Output 2 Run (default)  
Max 250 V AC or DC, 2 A AC, 18 W DC |
| A18, RO2C |  |

**Figure 3 - 15 NBIO-21 I/O Unit Terminal Connections.**
Figure 3 - 16 NBIO-21 I/O Unit Dimension Drawing.
The pulse encoder module (NTAC-02) is connected to channel CH1 on the NAMC board and activated by Parameter 98.01 ENCODER MODULE. The parameter 98.01 must be activated also with NIOB-01 basic I/O board. See also parameter 98.07.

The feedback used is indicated in the AUXILIARY STATUS WORD (8.02) bit 12.

B12: 0 = External pulse encoder
      1 = Internal speed

The Master / Follower Link

General

The Master/Follower Application macro is designed for applications in which the system is operated by several ACS 600 drives and the shafts are coupled to each other via gearing, chain, belt etc. The Master controls the Followers via a fibre optic serial communication link. The pulse encoder are recommended to use in both with the torque controlled followers.

The Master station is typically speed controlled and the other drives follow its torque or speed reference. In general, Torque control of the Follower should be used when the motor shafts of the Master and Follower drives are coupled fixedly to each other via gearing, a chain etc. and no speed difference between the drives is possible.

Link Configuration

Channel 2 (CH2) on the NAMC board is used for the Master/Follower link between the drives. The drive is programmable to be either the master or a follower in the communication. Typically the speed controlled process master drive is configured also to the communication master.

Master Drive

The torque reference source address is defined in the Master Drive by Parameter 70.11 MASTER REF3 to be sent as data set 41 to the follower drives. Speed reference 70.10 MASTER REF2 can also be sent through the link in the same DDCS message, if the follower is speed controlled. Typical parameter addresses are:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MASTER REF1 (70.09)</td>
<td>not in use</td>
</tr>
<tr>
<td>MASTER REF2 (70.10)</td>
<td>23.01 SPEED REF</td>
</tr>
<tr>
<td>MASTER REF3 (70.11)</td>
<td>2.10 TORQ REF 3</td>
</tr>
</tbody>
</table>

The parameters above have no meaning in the follower drive.

The Master Drive cyclically sends Master References 1...3 in one DDCS message, a broadcast every 2 milliseconds.
If the Follower mode is selected by Parameter **70.08 CH2 M/F MODE**, connections are fixed in the program as follows:

<table>
<thead>
<tr>
<th>Dataset Number</th>
<th>Dataset Index</th>
<th>Interval</th>
<th>Address</th>
<th>Parameter Name</th>
<th>Signal to be Monitored</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>2 ms</td>
<td>23.01</td>
<td>not in use</td>
<td>2.19 DS SPEED REF</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2 ms</td>
<td>25.01</td>
<td>SPEED REF</td>
<td>2.20 DS TORQ REF A</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>2 ms</td>
<td></td>
<td>TORQ REF A</td>
<td></td>
</tr>
</tbody>
</table>

The Follower mode includes only fast data read from data set 41 into the speed and torque reference chain. Therefore this mode can also be used with the overriding system connected to CH0, typically when fast communication is required but there is no need for a real Master/Follower application.

In some applications, both speed and torque control of the Followers are required, e.g. if it is necessary to accelerate all drives along the same speed ramp up to a certain speed before torque control can be started. In those cases, a “flying” switching between speed and torque control is required. The switching is done by controlling parameter **26.01 TORQ REF SEL** from the overriding system. See also **ACW (7.02)** bit 7 for window control information.
Chapter 3 – Software Description

Follower Diagnostics

All Followers receive the torque reference through the TORQUE REF A signal. The follower drive is able to detect a communication break, the action upon which is defined by Parameter 70.13 CH2 TIMEOUT and 70.14 CH2 COM LOSS CTRL. Diagnostics feedback from the followers must be handled by the overriding system through channel CH0 on the NAMC board.

Master/Follower Link Specification

Size of the Link: One Master and maximum 10 Follower stations. If more than 10 followers are required, an ABB representative should be consulted. The maximum length of the fibre optic cables (POF) is 10 metres.

Configuration: The Link is configurable by the application in the overriding system. (See Parameter 70.08 CH2 M/F MODE). This makes possible to change Master and Follower on-line through CH0 by an overriding system or application without changes in the hardware.

Transmission Rate: 4 Mbit/s

Total Performance of Link: < 5 ms to transfer references between the master and follower drives.

Protocol: Distributed Drives Communication System, DDCS

Diagnostics

General

A common method of drive diagnostics is to provide the user with information on previous conditions. Signals, data loggers, event loggers, and fault loggers are commonly implemented in most modern drives.

The following is a description of the data, event, and fault loggers available in the System Application Program.

Fault and Event Loggers

The fault logger collects 64 of the most recent faults into the fault buffer in the RAM memory. The latest 16 faults are stored into the FLASH memory at the beginning of an auxiliary power loss. The fault logger records all available information from the drive including faults, alarms, reset and system messages.

AMC Time Format and Counting

The Time for the logger fault is taken from the power-on counter, whose format is 9999 hr, xx min, yy.yyyy s. However, the counter can be updated cyclically from the overriding system if the system includes an overriding controller (for example AC 80). DriveWindow and the CDP 312 Control Panel show the real date and time.
The purpose of the Data Logger is to collect the history of signals related to an incident and store them for later retrieval and analysis. The contents of the Data Loggers are stored to the RAM memory. There are two Data loggers in the NAMC-51 board.

The both Data Loggers consist of 1...4 channels and the total memory size is 1024 bytes. The maximum number of samples depends on the data type:

- Integer type signal or parameters reserve 1 byte
- Real-type values reserve 2 bytes

Example: Four real-type signals are measured in the Data Logger 1. The maximum number of sample is 1024/(2 bytes x 4 channels) = 128.

The Data Loggers store the selected signals to the RAM memory every 5 milliseconds.

Default signals and parameters in Data Logger 1 are monitored:

1.01 MOTOR SPEED FILT
1.07 MOTOR TORQUE FILT
23.1 SPEED REF
25.1 TORQUE REF A

Default signals in Data Logger 2 are monitored:

1.02 SPEED ESTIMATED
1.10 DC VOLTAGE
1.12 PP TEMP
2.15 FLUX ACT

The signals to be monitored can be selected from DriveWindow. The default triggering mode is Fault.

The number of Pulse Encoder pulses can be counted and set using 7.02 ACW bits B9...11. The SYNC_COMMAND can also be given by I/O to minimise the delays. See Parameter 10.04 SYNC CMD. The calculation has two output modes: counted number of pulses or number of revolutions and motor shaft position in degrees.

Actual signals for this function are described in group 3 (3.07...3.10), commands in the ACW (7.02) and the parameters in Group 50 (50.07...50.12).
A basic function can be seen in the following diagram. When synchronisation is enabled (SYNC_DISABLE = 0) and the next positive edge of the SYNC_COMMAND is encountered, the initial values of POS_COUNT_INIT_LOW and POS_COUNT_INIT_HIGH are loaded into the counter and the counting continues. The Initial values can only be used for the pulse edges count mode. Status signal SYNC_RDY is set to indicate controlled SYNC_COMMAND. When the positioning has been completed by the overriding system (i.e. the motor can be stopped or some other sequence started), parameter SYNC_RDY can be reset by RESET_SYNC_RDY.
Chapter 3 – Software Description

**Back-Up of Parameters or Software**

At the end of the commissioning of the ACS 600, backing up the (NAMC board) parameters is recommended. The results of the Motor ID Run should also be backed up. If necessary, the data can be restored later on (e.g. downloaded to a spare board of the same type). See instructions in appendix A.

The back-up can be done either with DriveWindow or the CDP 312 control panel (there is an EEPROM memory in the panel). In case of CDP 312, see Chapter 6.

**Spare NAMC Boards**

One spare NAMC board or NDCU unit for each application software type (e.g. System, Standard, Crane etc.) cover the whole ACS 600 MultiDrive power range, downloaded with the same firmware as in the drives. See signal 4.01 in the drive for firmware version.

Inverter ratings can be NONE (no ratings entered) or any inverter type for spare part NAMC board.

---

**Figure 3 - 19 Example of the Positioning Counting Function**

- **SYNC_COMMAND 7.02 B9**
- **SYNC_DISABLE 7.02 B10**
- **SYNC_RDY 8.02 B5**
- **RESET_SYNC_RDY 7.02 B11**
- **ENCODER PULSES**
- **POS_COUNT_LOW 3.07**
- **POS_COUNT_HIGH 3.08**
or
- **POS_COUNT_ROUNDS 3.10**
- **POS_COUNT_DEGREES 3.09**
- **POS_COUNT_INIT_LO 50.08**
- **POS_COUNT_INIT_HI 50.09**

Figure: POSC_TIM.drw
Chapter 3 – Software Description

DriveWindow Back-Up Function

DriveWindow has a back-up function. The back-up is activated from the DRIVE menu, and it has the following alternatives:

- **COMPLETE BACK-UP** saves the PARAMETER.DDF file from the NAMC board including nominal values of inverter. The file extension is *.DDB.

- **ID RUN** results: first start, Standard ID Run or Reduced ID Run.

- **USER's DATA** (parameter groups 10...98). The file extension for Motor ID RUN and USER's DATA is *.DWB. See instructions in appendix A.

DriveWindow Restore Function

Restoring a **COMPLETE BACK-UP** downloads the whole contents of the PARAMETER.DDF file to FPROM (Flash PROM memory) on the NAMC board. This is the easiest and recommended way to restore parameters to a spare board, because it also restores the inverter nominal values. The board and loading package types (e.g. NAMC-51 and AM4G6000) of the original and spare board must match. See signal 4.01 in the drive.

By selecting both **ID RUN** results and **USER's DATA**, the saved parameters can be restored to a spare NAMC board which has the same or later loading package version. The warning message about different software versions is accepted in the version update. The Restore function is also activated from the DRIVE menu.

However, the user must be very careful to select the correct back-up file to be restored. It must always be verified that the restored inverter values match actual hardware. The compare function of DriveWindow can be used for this.

**Note:** When USER MACROs are in use, the back-up and restore must be executed for both. First activate USER_MACRO1 by Parameter 99.11 APPLICATION MACRO and make a back-up, then activate USER_MACRO2 and make another back-up. When restoring, save the restored parameters to USER_MACRO1 and USER_MACRO2 from the original back-up files.

The back-up files should be named logically and clearly to identify the corresponding ACS 600 drive. The process name of the drive can be typed into Parameter 97.01 DEVICE NAME (example: Unwinder 1) and it can be seen in the DriveWindow main menu (when drives are connected). This also helps the identification of the back-up files.
Memory Handling

- The Power-Up procedure loads all the needed files to the RAM. This takes about 6 seconds.
- Parameter value changes mode with Drive Window or CDP 312 are stored to RAM and FPROM.
- Parameter value changes by the overriding system are stored only to RAM. However, saving to FPROM can be executed by setting parameter 16.06 PARAMETER BACKUP to SAVE. This function can be used when the parameter changes made by the overriding system are to be saved.
- The factory default settings can be restored in a similar way.
- The Power Down task saves 16 latest faults or alarms to the FPROM.

User Macros

There are three parameter files available in the FPROM memory: PARAMETER.DDF, USER_MACRO1.DDF and USER_MACRO2.DDF. There are two user macro parameter sets available. They can be saved and restored by Parameter 99.09 and 99.11.

Normally, when the user macros are not used, all the parameter changes are saved automatically to file PARAMETER.ddf. When the User Macros are in use, all the parameter changes must be saved to the corresponding User Macro file by parameter 99.11 APPLICATION MACRO.

User Macros can also be activated by ACW2 (7.03) bit 12 (TRUE = USER MACRO2, FALSE = USER MACRO1), if the function is enabled by parameter 16.05 USER MACRO CHG. The status of the active macro can be seen in the ASW (8.02) bit 14 USER MACRO 1 and bit 15 USER MACRO 2.
Oscillation Damping

Oscillation Damping algorithm has been developed in order to damp mechanical oscillations. As an output the algorithm produces a sine wave. This sine wave can be summed to torque reference with suitable gain and phase.

![Figure 3 - 20 Torque Reference Chain](image)

Algorithm has four parameters:

- **26.04 OSC COMPENSATION**
  - ON/OFF Enables/disables calculations

- **26.05 OSCILLATION FREQ**
  - 0-60 Hz Frequency of the oscillation

- **26.06 OSCILLATION PHASE**
  - 0-360° Phase angle of the sine wave

- **26.07 OSCILLATION GAIN**
  - 0-100% Relative gain (scaled according to speed controller gain)

**Tuning Procedure**

Tuning is done as follows:

1. Set parameter OSC COMPENSATION ON and OSCILLATION GAIN to value 0%.
2. Calculate the oscillation frequency and set parameter OSCILLATION FREQ.
3. OSCILLATION PHASE can be in its default value or you can change it.
4. Increase OSCILLATION GAIN gradually (5%, 10%,...) so that you can see whether the used phase angle is good (oscillation amplitude decreases) or bad (oscillation is being amplified).
5. If amplitude of the oscillation decreases, increase gain and change phase sensitively. Otherwise try a different phase angle until the oscillation amplitude decreases.
6. When the **OSCILLATION PHASE** is set so that oscillation amplitude decreases, increase the gain to suppress the oscillation totally.

<table>
<thead>
<tr>
<th>OSCILLATION GAIN = 0%</th>
<th>OSC COMPENSATION: ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set OSCILLATION FREQ</td>
<td></td>
</tr>
<tr>
<td>Increase OSCILLATION GAIN so that algorithm effects system (5...10%)</td>
<td></td>
</tr>
</tbody>
</table>

Oscillation amplitude decreases: Increase OSCILLATION GAIN and do minor changes (if needed) to OSCILLATION PHASE.

Oscillation amplitude increases: Try other values for OSCILLATION PHASE.

| Increase OSCILLATION GAIN so that there is no more oscillation. |

**Figure 3 - 21 Tuning Procedure for the Oscillation Damping**

**Note:** Changing the speed error lowpass filter time constant and speed controller's integration time may have an impact on the oscillation damping algorithm tuning. It is recommended to tune speed controller before tuning this algorithm. Speed controller gain can be altered after tuning the oscillation damping algorithm.

**AUTO RESTART Function**

It is possible to restart the drive(s) with the AUTO RESTART function after a short (max. 5 seconds) power supply failure without actions by the overriding system. This function is enabled by Par. **21.09 AUTO RESTART**. Par. **21.10 AUTO RESTART TIME** defines the maximum duration of the power failure. Actions on the net break are:

- Main Status Word is frozen and the FW2 bit 2 DC UNDERVOLT fault is masked in the Fault Word.
- The undervoltage fault is reset internally
- An undervoltage alarm is set in the AW2 bit 14.
- MCW bit 0 is changed 1 --> 0 --> 1
- Flying start mode is forced temporarily (21.01 = AUTO).
- After a successful restart: MSW freezing, FW masking and the original START MODE are reinstated otherwise after 6 seconds.
- An alarm “AUTORESTARTED” is given.
Chapter 4 – Signals

Overview

This chapter describes the measured and calculated actual signals, and the content of the control, status, limit, fault, and alarm words of the ACS 600.

How to Read the Signal Table

Before you start to read the signal table, we first recommend you read this description.

ACS 600 Signals

<table>
<thead>
<tr>
<th>Group + Index</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1…1.27</td>
<td>Actual Signals</td>
<td>27</td>
</tr>
<tr>
<td>2.1…2.24</td>
<td>Actual Signals</td>
<td>24</td>
</tr>
<tr>
<td>3.1…3.15</td>
<td>Actual Signals</td>
<td>15</td>
</tr>
<tr>
<td>4.1…4.3</td>
<td>Information</td>
<td>3</td>
</tr>
<tr>
<td>5.1…5.32</td>
<td>(reserved for the application)</td>
<td></td>
</tr>
<tr>
<td>6.1…6.32</td>
<td>(reserved for the application)</td>
<td></td>
</tr>
<tr>
<td>7.1…7.3</td>
<td>Control Words</td>
<td>3</td>
</tr>
<tr>
<td>8.1…8.6</td>
<td>Status Words, Limit Words</td>
<td>6</td>
</tr>
<tr>
<td>9.1…9.7</td>
<td>Fault Words, Alarm Words</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>85</strong></td>
</tr>
</tbody>
</table>

Figure 4 - 1 Sample of an Actual Signal table

- All signals are read-only. However the overriding system can write to the control words, but it only affects the RAM memory.
- If the overriding control system reads or writes individual bits of a word with an Advant CONV_IB element, (for example AUX CONTROL WORD 7.02) the bit B15 corresponds to the SIGN outputs of the element.
- If signal type is R (real value), it also has an integer scaling relation mentioned in the column Integer scaling. For example, if the CURRENT signal is read to the overriding system, an integer value of 10 corresponds to 1 Ampere. All the read and sent values are limited to 16 bits (-32768…32767).
- The unit of the signal value can be seen on the lower left-hand corner of the signal description.
- Minimum and maximum values are shown in decimal format.
- Data type is given with a short code:
  - I = 16-bit signed integer
  - B = Boolean value
  - PB = Packed Boolean value
  - R = Real value

ACS 600 Firmware Manual, System Application Program 6.x
## AMC Table Signals

### Group 1 Actual Signal

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>Description</th>
<th>unit</th>
<th>type</th>
<th>Min:</th>
<th>Max:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>MOTOR SPEED FILT</td>
<td>Filtered actual speed according to the speed feedback selection. Filter time constant is adjustable by Par. 50.12 MOTOR SP FILT TIME. Default filter time constant is 500 ms + Parameter 50.06 SP ACT FILT TIME with pulse encoder. See also Parameter 50.03.</td>
<td>rpm</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>SPEED ESTIMATED</td>
<td>Internally calculated actual speed.</td>
<td>rpm</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>SPEED MEASURED</td>
<td>Measured actual speed from the pulse encoder.</td>
<td>rpm</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>MOTOR SPEED</td>
<td>Actual speed to the speed error calculation of the speed controller.</td>
<td>rpm</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>FREQUENCY</td>
<td>Calculated frequency of the motor.</td>
<td>Hz</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>MOTOR CURRENT</td>
<td>Measured motor current absolute value.</td>
<td>A</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07</td>
<td>MOTOR TORQ FILT2</td>
<td>Filtered motor torque in percent of the rated motor torque. See also parameter 25.07.</td>
<td>%</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08</td>
<td>MOTOR TORQUE</td>
<td>Motor torque in percent of the rated motor torque.</td>
<td>%</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09</td>
<td>POWER</td>
<td>Motor power in percent of the rated motor power.</td>
<td>%</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>DC VOLTAGE</td>
<td>Measured dc bus voltage</td>
<td>V</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>MOTOR VOLTAGE</td>
<td>Calculated motor output voltage.</td>
<td>V</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>PP TEMP</td>
<td>Temperature of the heat sink plate in degrees centigrade.</td>
<td>°C</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>TIME OF USAGE</td>
<td>This actual signal is an elapsed mains-on time indicator.</td>
<td>h</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>KILOWATT HOURS</td>
<td>This actual signal counts the kilowatt hours in operation.</td>
<td>kWh</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index</td>
<td>Group name:</td>
<td>Description</td>
<td>Unit</td>
<td>Type</td>
<td>Min</td>
<td>Max</td>
<td>Integer scaling</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>-------------</td>
<td>------</td>
<td>------</td>
<td>-----</td>
<td>-----</td>
<td>-----------------</td>
</tr>
<tr>
<td>15</td>
<td>DI6-1 STATUS</td>
<td>Status of the digital inputs DI6...DI1 in the software. Example: DI1 and DI4 are activated. Table format: 0001001 (CDP 312 display) DI name 654321</td>
<td>I</td>
<td>Min: 0</td>
<td>Max: 127</td>
<td>Integer scaling: 1 == 1</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>MOTOR 1 TEMP</td>
<td>Value of analogue input 1 displayed in °C (PT100 measurement) or Ω (PTC measurement).</td>
<td>°C</td>
<td>Min:</td>
<td>Max:</td>
<td>Integer scaling: 1 == 1°C or 1 Ω</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>MOTOR 2 TEMP</td>
<td>Value of analogue input 2 displayed in °C (PT100 measurement) or Ω (PTC measurement).</td>
<td>°C</td>
<td>Min:</td>
<td>Max:</td>
<td>Integer scaling: 1 == 1°C or 1 Ω</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>MOTOR TEMP EST</td>
<td>Calculated motor temperature when the thermal model (DTC or User mode) is used for motor overtemperature protection.</td>
<td>°C</td>
<td>Min:</td>
<td>Max:</td>
<td>Integer scaling: 1 == 1°C</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>AI1 [V]</td>
<td>Non-scaled value of analogue input AI1. See Parameters 13.01...13.02.</td>
<td>R</td>
<td>Min: 0</td>
<td>Max: 10</td>
<td>Integer scaling: 10000 == 10V or 20 mA</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>AI2 [mA]</td>
<td>Non-scaled value of analogue input AI2. See Parameters 13.04...13.05.</td>
<td>R</td>
<td>Min: 0</td>
<td>Max: 20</td>
<td>Integer scaling: 20000 == 20mA, 2 V or 10 V</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>AI3 [mA]</td>
<td>Non-scaled value of analogue input AI3. See Parameters 13.08...13.09.</td>
<td>R</td>
<td>Min: 0</td>
<td>Max: 20</td>
<td>Integer scaling: 20000 == 20mA</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>RO3-1 STATUS</td>
<td>Status of the basic I/O board relay outputs RO3 ... RO1. Example: RO2 and RO3 are activated. Table format: 0000110 (CDP 312 display view) RO name 321</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>AO1 [mA]</td>
<td>Value of analogue output AO1 in milliamperes. See Parameter Group 15 for signal selection and scaling.</td>
<td>mA</td>
<td>Min: 0 mA</td>
<td>Max: 20 mA</td>
<td>Integer scaling: 20000 == 20mA</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>AO2 [mA]</td>
<td>Value of analogue output AO2 in milliamperes. See Parameter Group 16 for signal selection and scaling.</td>
<td>mA</td>
<td>Min: 0 mA</td>
<td>Max: 20 mA</td>
<td>Integer scaling: 20000 == 20mA</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>CONTROL MODE</td>
<td>Control mode in use: 1 = Speed control 2 = Torque control (TORQ_REF_1 affects the output of TORQ REF 3)</td>
<td>I</td>
<td>Min: 1</td>
<td>Max: 2</td>
<td>Integer scaling:</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>LED PANEL OUTPUT</td>
<td>Output monitoring of the NLMD-01 LED panel. See Parameter Group 18.</td>
<td>%</td>
<td>Min:</td>
<td>Max:</td>
<td>Integer scaling: 1 == 1</td>
<td></td>
</tr>
</tbody>
</table>
### Chapter 4 – Signals

#### Group 2 Actual Signals

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>Description</th>
<th>Index Description</th>
<th>Unit</th>
<th>Type</th>
<th>Min</th>
<th>Max</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>ACTUAL SIGNALS</td>
<td>Measured or calculated values in the speed and torque reference chain.</td>
<td>Limited speed reference.</td>
<td>rpm</td>
<td>R</td>
<td>-18000</td>
<td>18000</td>
<td>see Par. 50.01</td>
</tr>
<tr>
<td>02</td>
<td>ACTUAL SIGNALS</td>
<td>P part effect at the output of the PID controller. Output of the PID controller is formed from the output parameters</td>
<td>Limited speed reference.</td>
<td>rpm</td>
<td>R</td>
<td>-18000</td>
<td>18000</td>
<td>see Par. 50.01</td>
</tr>
<tr>
<td>03</td>
<td>ACTUAL SIGNALS</td>
<td>Difference between reference and the actual value. If parameter WINDOW_SEL_ON is enabled, SPEED_ERROR_NEG is filtered through the window function.</td>
<td>Difference between reference and the actual value. If parameter WINDOW_SEL_ON is enabled, SPEED_ERROR_NEG is filtered through the window function.</td>
<td>%</td>
<td>R</td>
<td></td>
<td></td>
<td>see Par. 50.01</td>
</tr>
<tr>
<td>04</td>
<td>ACTUAL SIGNALS</td>
<td>Limited torque reference value in the torque reference chain.</td>
<td>Limited torque reference value in the torque reference chain.</td>
<td>%</td>
<td>R</td>
<td></td>
<td></td>
<td>100 == 1 %</td>
</tr>
<tr>
<td>05</td>
<td>ACTUAL SIGNALS</td>
<td>Final torque reference from the speed control chain.</td>
<td>Final torque reference from the speed control chain.</td>
<td>%</td>
<td>R</td>
<td></td>
<td></td>
<td>100 == 1 %</td>
</tr>
<tr>
<td>06</td>
<td>ACTUAL SIGNALS</td>
<td>Torque reference after the torque selector block.</td>
<td>Torque reference after the torque selector block.</td>
<td>%</td>
<td>R</td>
<td></td>
<td></td>
<td>100 == 1 %</td>
</tr>
<tr>
<td>07</td>
<td>ACTUAL SIGNALS</td>
<td>Sum of TORQUE REF 3 and LOAD COMPENSATION.</td>
<td>Sum of TORQUE REF 3 and LOAD COMPENSATION.</td>
<td>%</td>
<td>R</td>
<td></td>
<td></td>
<td>100 == 1 %</td>
</tr>
<tr>
<td>08</td>
<td>ACTUAL SIGNALS</td>
<td>Sum of TORQUE REF 4 and TORQUE STEP.</td>
<td>Sum of TORQUE REF 4 and TORQUE STEP.</td>
<td>%</td>
<td>R</td>
<td></td>
<td></td>
<td>100 == 1 %</td>
</tr>
</tbody>
</table>

**ACTUAL SIGNALS**

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>Description</th>
<th>Index Description</th>
<th>Unit</th>
<th>Type</th>
<th>Min</th>
<th>Max</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>CABLE TEMPERATURE</td>
<td>Output monitoring of the motor cable thermal model. See Parameter Group 36.</td>
<td>Output monitoring of the motor cable thermal model. See Parameter Group 36.</td>
<td>%</td>
<td>R</td>
<td>0</td>
<td>100</td>
<td>1 == 1</td>
</tr>
<tr>
<td>Index</td>
<td>Description</td>
<td>Unit</td>
<td>Min</td>
<td>Max</td>
<td>Integer scaling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>------</td>
<td>-----</td>
<td>-----</td>
<td>-----------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Limited torque reference. This is the final torque input for the internal torque controller.</td>
<td>%</td>
<td>type: R</td>
<td>100 == 1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Flux reference used.</td>
<td>%</td>
<td>type: R</td>
<td>10 == 1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Flux actual value.</td>
<td>%</td>
<td>type: R</td>
<td>10 == 1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Speed reference change in rpm/s at the output of the speed ramp generator.</td>
<td>rpm/s</td>
<td>type: R</td>
<td>See Parameter 50.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Speed reference before speed error calculation.</td>
<td>rpm</td>
<td>type: R</td>
<td>See Parameter 50.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Speed reference from the Master Follower link to be monitored in the Follower drive.</td>
<td>rpm</td>
<td>type: R</td>
<td>See Parameter 50.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Torque reference from the Master Follower link to be monitored in the Follower drive.</td>
<td>rpm</td>
<td>type: R</td>
<td>See Parameter 50.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Actual field weakening point.</td>
<td>Hz</td>
<td>type: R</td>
<td>100 == 1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Torque reference after frequency limiter block.</td>
<td>%</td>
<td>type: R</td>
<td>100 == 1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Torque reference after DC-voltage limiter block.</td>
<td>%</td>
<td>type: R</td>
<td>100 == 1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Torque reference after power limiter block.</td>
<td>%</td>
<td>type: R</td>
<td>10 == 1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Group 3 Actual Signals**

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Unit</th>
<th>Min</th>
<th>Max</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Microprocessor load measurement. Value 100% indicates microprocessor overload, which results in delays in task executions.</td>
<td>%</td>
<td>type: R</td>
<td>1 == 1%</td>
<td></td>
</tr>
</tbody>
</table>
### Signals

**3 Group name:** ACTUAL SIGNALS

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Data type</th>
<th>Min</th>
<th>Max</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>APPLICATION OVERL</td>
<td>PB</td>
<td>0</td>
<td>Max</td>
<td>1 == 1</td>
</tr>
<tr>
<td>03</td>
<td>RS</td>
<td>R</td>
<td>0</td>
<td>Max</td>
<td>100 == 1 Ω</td>
</tr>
<tr>
<td>04</td>
<td>LS</td>
<td>R</td>
<td>0</td>
<td>Max</td>
<td>100 == 1 mH</td>
</tr>
<tr>
<td>05</td>
<td>SIGMALS</td>
<td>R</td>
<td>0</td>
<td>Max</td>
<td>100 == 1 Ω</td>
</tr>
<tr>
<td>06</td>
<td>TR</td>
<td>R</td>
<td>0</td>
<td>Max</td>
<td>1 == 1 ms</td>
</tr>
<tr>
<td>07</td>
<td>POS COUNT LOW</td>
<td>I</td>
<td>0</td>
<td>Max</td>
<td>65536</td>
</tr>
<tr>
<td>08</td>
<td>POS COUNT HIGH</td>
<td>I</td>
<td>0</td>
<td>Max</td>
<td>65536</td>
</tr>
<tr>
<td>09</td>
<td>POS COUNT DEGREES</td>
<td>R</td>
<td>-360 deg</td>
<td>360 deg</td>
<td>1 == 1 deg</td>
</tr>
<tr>
<td>10</td>
<td>POS COUNT ROUNDS</td>
<td>R</td>
<td>-8388608</td>
<td>8388608</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>

- **02 APPLICATION OVERL:** Possible overload of each application task can be detected by means of this signal in the Packed Boolean format.
  - Bit 0: Application Task 1 overload
  - Bit 1: Application Task 2 overload
  - Bit 2: Application Task 3 overload
  - Bit 3: Application Task 4 overload
  - Bit 4: Application Task 5 overload
  - Bit 5: Application Task 6 overload

- **03 RS:** Estimated stator resistance \( R_s \)
  - \( \text{unit: } \Omega \)
  - \( \text{type: R} \)
  - \( \text{Min: 0} \)
  - \( \text{Max: } \)
  - \( \text{Integer scaling: } 100 == 1 \Omega \)

- **04 LS:** Estimated stator inductance \( L_s \)
  - \( \text{unit: mH} \)
  - \( \text{type: R} \)
  - \( \text{Min: 0} \)
  - \( \text{Max: } \)
  - \( \text{Integer scaling: } 100 == 1 \text{ mH} \)

- **05 SIGMALS:** Estimated value of \( \sigma_s \)
  - \( \text{unit: } \Omega \)
  - \( \text{type: R} \)
  - \( \text{Min: 0} \)
  - \( \text{Max: } \)
  - \( \text{Integer scaling: } 100 == 1 \Omega \)

- **06 TR:** Estimated time constant of the rotor.
  - \( \text{unit: ms} \)
  - \( \text{type: R} \)
  - \( \text{Min: 0} \)
  - \( \text{Max: } \)
  - \( \text{Integer scaling: } 1 == 1 \text{ ms} \)

- **07 POS COUNT LOW:** Position counter value in pulses (low word).
  - \( \text{unit: type: I} \)
  - \( \text{Min: 0} \)
  - \( \text{Max: 65536} \)
  - \( \text{Integer scaling: } 1 == 1 \)

- **08 POS COUNT HIGH:** Position counter value in pulses (high word).
  - \( \text{unit: type: I} \)
  - \( \text{Min: 0} \)
  - \( \text{Max: 65536} \)
  - \( \text{Integer scaling: } 1 == 1 \)

- **09 POS COUNT DEGREES:** Position counter value in degrees, when parameter 50.07 POS COUNT MODE has selection ROUND&DEG. This signal is used together with signal 3.10 POS COUNT ROUNDS.
  - \( \text{unit: deg} \)
  - \( \text{type: R} \)
  - \( \text{Min: -360 deg} \)
  - \( \text{Max: 360 deg} \)
  - \( \text{Integer scaling: } 1 == 1 \text{ deg} \)

- **10 POS COUNT ROUNDS:** Position counter value in total shaft revolutions, when Parameter 50.07 POS COUNT MODE is set to ROUND&DEG.
  - \( \text{unit: type: R} \)
  - \( \text{Min: -8388608} \)
  - \( \text{Max: 8388608} \)
  - \( \text{Integer scaling: } 1 == 1 \)
### Chapter 4 – Signals

#### Group name: ACTUAL SIGNALS

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Data logger 1 STATUS WORD</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>triggering conditions: fault</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>triggering conditions: level</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>triggering conditions: alarm</td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>triggering conditions: limit</td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>triggered by user</td>
<td></td>
</tr>
<tr>
<td>B5</td>
<td>triggered from level</td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td>trend triggered from difference</td>
<td></td>
</tr>
<tr>
<td>B7</td>
<td>initialising</td>
<td></td>
</tr>
<tr>
<td>B8</td>
<td>over_write (readpointer has reached write pointer)</td>
<td></td>
</tr>
<tr>
<td>B9</td>
<td>filled</td>
<td></td>
</tr>
<tr>
<td>B10</td>
<td>running</td>
<td></td>
</tr>
<tr>
<td>B11</td>
<td>initialised</td>
<td></td>
</tr>
<tr>
<td>B12</td>
<td>not initialised</td>
<td></td>
</tr>
<tr>
<td>B13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Unit:** type: I  
Min: -32768  
Max: 32767  
Integer scaling:

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>PP 0 TEMP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The highest power plate temperature in degrees celsius from the module 0 in the parallel connected inverter. The IGBT module with the highest temperature is indicated by the LEDs in the NINT board. This measurement is active only with parallel connected inverters.</td>
<td></td>
</tr>
<tr>
<td>unit: °C</td>
<td>type: R</td>
<td>Min:</td>
</tr>
<tr>
<td>Max:</td>
<td>Integer scaling: 1 == 1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>PP 1 TEMP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The highest power plate temperature in degrees celsius from the module 1 in the parallel connected inverter. The IGBT module with the highest temperature is indicated by the LEDs in the NINT board. This measurement is active only with parallel connected inverters.</td>
<td></td>
</tr>
<tr>
<td>unit: °C</td>
<td>type: R</td>
<td>Min:</td>
</tr>
<tr>
<td>Max:</td>
<td>Integer scaling: 1 == 1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>PP 2 TEMP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The highest power plate temperature in degrees celsius from the module 2 in the parallel connected inverter. The IGBT module with the highest temperature is indicated by the LEDs in the NINT board. This measurement is active only with parallel connected inverters.</td>
<td></td>
</tr>
<tr>
<td>unit: °C</td>
<td>type: R</td>
<td>Min:</td>
</tr>
<tr>
<td>Max:</td>
<td>Integer scaling: 1 == 1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>PP 3 TEMP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The highest power plate temperature in degrees celsius from the module 3 in the parallel connected inverter. The IGBT module with the highest temperature is indicated by the LEDs in the NINT board. This measurement is active only with parallel connected inverters.</td>
<td></td>
</tr>
<tr>
<td>unit: °C</td>
<td>type: R</td>
<td>Min:</td>
</tr>
<tr>
<td>Max:</td>
<td>Integer scaling: 1 == 1</td>
<td></td>
</tr>
</tbody>
</table>
### Group 4 Information

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td><strong>SOFTWARE VERSION</strong>&lt;br&gt;This signal gives information on the downloaded loading package information.</td>
</tr>
</tbody>
</table>

**Product**
- A = Inverter software based on ACS 600 platform
- D = DC drives software based on ACS 600 platform
- I = Input bridge software based on ACS 600 platform
- L = Large Drives software based on ACS 600 platform
- M = ACS1000 software

**Software Product**
- C = ACS 600 Crane appl.
- F = ACF 600
- H = ACS 600 PFC Macro
- M = ACS 600 System Application
- N = ACS 600 PMSM System Application
- P = ACP 600 Motion Control Application
- S = ACS 600 Standard Application
- T = ACS 600 PCB Application Template
- U = ACS 600 Water Cooling Unit Application

**Inverter Hardware type**
- 0 = Single Drive HW (old HW) *
- 1 = Single Drive XT-HW
- 2 = reserved
- 3 = reserved
- 4 = MultiDrive non-parallel connected HW
- 5 = MultiDrive parallel connected HW
- 6 = Single Drive HW (1998 HW)**
- A = Custom Application Software
- X = Multiple

**NAMC-board type**
- A = software for NAMC-03 or NAMC-04 Control Board
- M = software for NAMC-03 or NAMC-04 Control Board
- B = software for NAMC-2x Control Board
- C = software for AMC 3 Control Board
- D = reserved for N2AC AMC Board
- E = software for NAMC-11 Control Board
- G = software for NAMC-51 Control Board

**Examples**
- AM4G6000  = System Application SW for parallel connected MultiDrive HW
- AM5G6000  = System Application SW for parallel connected MultiDrive HW
- AM6G6000  = System Application SW for parallel connected MultiDrive HW
- AM1G6000  = System Application SW for Standard HW
- AM2G6000  = System Application SW for Standard HW
- AS1G6000  = Standard Application SW for non-parallel connected MultiDrive HW
- AS2G6000  = Standard Application SW for parallel connected MultiDrive HW

* Serial number <1984100000 and 22. character in the type code is 0 or C.
** Serial number >1994100000 and 22. character in the type code is 1 or D.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td><strong>DTC SW VERSION</strong>&lt;br&gt;Flux software version. This fixed part of the application program consists of motor control, operational system, communication control of the DDCS channels, and Modbus software for the control panel.</td>
</tr>
<tr>
<td>03</td>
<td><strong>APPLIC SW VERSION</strong>&lt;br&gt;Application software name. This part of the application program has been written using PC element programming.</td>
</tr>
</tbody>
</table>
## Group 7 Control Words

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Value</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>ON</td>
<td>1</td>
<td>Command to “RDYRUN”-state</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>Command to “OFF”-state</td>
</tr>
<tr>
<td>B1</td>
<td>OFF 2</td>
<td>1</td>
<td>No OFF 2 (Emergency OFF or Coast Stop)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>Command to “ON INHIBIT” state</td>
</tr>
<tr>
<td>B2</td>
<td>OFF 3</td>
<td>1</td>
<td>No OFF 3 (Emergency STOP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>Command to “ON INHIBIT” state</td>
</tr>
<tr>
<td>B3</td>
<td>RUN</td>
<td>1</td>
<td>Command to “RDYREF”-states</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>Stop by coasting</td>
</tr>
<tr>
<td>B4</td>
<td>RAMP_OUT_ZERO</td>
<td>1</td>
<td>Speed ramp output is forced to zero</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B5</td>
<td>RAMP_HOLD</td>
<td>1</td>
<td>Speed ramping stopped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td>RAMP_IN_ZERO</td>
<td>1</td>
<td>Speed ramp input is forced to zero</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B7</td>
<td>RESET</td>
<td>1</td>
<td>Fault resetting with a positive edge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B8</td>
<td>INCHING1</td>
<td>1</td>
<td>Constant speed 1 defined by a parameter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B9</td>
<td>INCHING2</td>
<td>1</td>
<td>Constant speed 2 defined by a parameter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B10</td>
<td>REMOTE_CMD</td>
<td>1</td>
<td>Overriding computer is req. to control the drive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>Only OFF commands are valid</td>
</tr>
<tr>
<td>B11</td>
<td>reserved</td>
<td>1</td>
<td>(reserved)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B12</td>
<td>reserved</td>
<td>1</td>
<td>(reserved)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B13</td>
<td>reserved</td>
<td>1</td>
<td>(reserved)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B14</td>
<td>reserved</td>
<td>1</td>
<td>(reserved)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>B15</td>
<td>reserved</td>
<td>1</td>
<td>(reserved)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Unit:** type: I  Min: -32768  Max: 32767  Integer scaling:
### CONTROL WORDS

#### AUX CONTROL WORD 1 (ACW_1)

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>RESTART_DLOG</td>
<td>B7</td>
<td>WINDOW_CTRL</td>
</tr>
<tr>
<td>B1</td>
<td>TRIGG_LOGGER</td>
<td>B8</td>
<td>BAL_NCONT</td>
</tr>
<tr>
<td>B2</td>
<td>RAMP_BYPASS</td>
<td>B9</td>
<td>SYNC_COMMAND</td>
</tr>
<tr>
<td>B3</td>
<td>BAL_RAMP_OUT</td>
<td>B10</td>
<td>SYNC_DISABLE</td>
</tr>
<tr>
<td>B4</td>
<td>FLUX_ON_DC</td>
<td>B11</td>
<td>RESET_SYNC_RDY</td>
</tr>
<tr>
<td>B5</td>
<td>FLUX_ON</td>
<td>B12</td>
<td>(reserved)</td>
</tr>
<tr>
<td>B6</td>
<td>HOLD_NCONT</td>
<td>B13</td>
<td>DO1 CONTROL</td>
</tr>
<tr>
<td>B7</td>
<td></td>
<td>B14</td>
<td>DO2 CONTROL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B15</td>
<td>DO3 CONTROL</td>
</tr>
</tbody>
</table>

- **RESTART_DLOG**: Restart data logger (rising edge).
- **TRIGG_LOGGER**: Data logger triggering (rising edge).
- **RAMP_BYPASS**: Bypass Speed ramp.
- **BAL_RAMP_OUT**: Force ramp output.
- **FLUX_ON_DC**: Flux on DC. (Flux off: set this bit and MCW bit 3 to 0).
- **FLUX_ON**: Flux on (zero torque).
- **HOLD_NCONT**: Hold the integral part in the speed controller.
- **WINDOW_CTRL**: FALSE = ADD CONTROL, TRUE = Window Control.
- **BAL_NCONT**: Force speed controller output.
- **SYNC_COMMAND**: Position counting: synchronise command.
- **SYNC_DISABLE**: Position counting: disable synchronise command.
- **RESET_SYNC_RDY**: Position counting: reset synchronous ready command.
- **DO1 CONTROL**: SW DO1 control (see also Par. 14.01, 14.02 and 98.03).
- **DO2 CONTROL**: SW DO2 control (see also Par. 14.04 and 98.03).
- **DO3 CONTROL**: SW DO3 control (see also Par. 14.06 and 98.03).

#### AUX CONTROL WORD 2 (ACW_2)

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>EXT1_DO1_CTRL</td>
<td>B7</td>
<td>USER_MACRO_CTRL</td>
</tr>
<tr>
<td>B1</td>
<td>EXT1_DO2_CTRL</td>
<td>B8</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>EXT2_DO1_CTRL</td>
<td>B9</td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>EXT2_DO2_CTRL</td>
<td>B10</td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>EXT3_DO1_CTRL</td>
<td>B11</td>
<td></td>
</tr>
<tr>
<td>B5</td>
<td>EXT3_DO2_CTRL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **EXT1_DO1_CTRL**: NDIO extension module 1 DO1 control.
- **EXT1_DO2_CTRL**: NDIO extension module 1 DO2 control.
- **EXT2_DO1_CTRL**: NDIO extension module 2 DO1 control.
- **EXT2_DO2_CTRL**: NDIO extension module 2 DO2 control.
- **EXT3_DO1_CTRL**: NDIO extension module 3 DO1 control.
- **EXT3_DO2_CTRL**: NDIO extension module 3 DO2 control.
- **USER_MACRO_CTRL**: Macro change request. TRUE= macro 2, FALSE= macro 1.
### Group 8 Status Words

<table>
<thead>
<tr>
<th>Index</th>
<th>Bit</th>
<th>Name</th>
<th>Value</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>B0</td>
<td>RDYON</td>
<td>1</td>
<td>Ready to switch on</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>Not ready to switch on</td>
</tr>
<tr>
<td>01</td>
<td>B1</td>
<td>RDYRUN</td>
<td>1</td>
<td>Ready</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>Not ready</td>
</tr>
<tr>
<td>01</td>
<td>B2</td>
<td>RDYREF</td>
<td>1</td>
<td>Operation enabled (RUNNING)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>Operation inhibited</td>
</tr>
<tr>
<td>01</td>
<td>B3</td>
<td>TRIPPED</td>
<td>1</td>
<td>Fault</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>B4</td>
<td>OFF_2_STA</td>
<td>1</td>
<td>No OFF 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>OFF 2</td>
</tr>
<tr>
<td>01</td>
<td>B5</td>
<td>OFF_3_STA</td>
<td>1</td>
<td>No OFF 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>OFF 3</td>
</tr>
<tr>
<td>01</td>
<td>B6</td>
<td>SWC ON INHIB</td>
<td>1</td>
<td>Switch on inhibit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>B7</td>
<td>ALARM</td>
<td>1</td>
<td>Alarm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>B8</td>
<td>AT_SETPOINT</td>
<td>1</td>
<td>Setpoint/act. value monitoring in the tolerance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>B9</td>
<td>REMOTE</td>
<td>1</td>
<td>Remote control</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>Local control</td>
</tr>
<tr>
<td>01</td>
<td>B10</td>
<td>ABOVE_LIMIT</td>
<td>1</td>
<td>Frequency or speed &gt; par. 50.10 Speed Above Limit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>B11</td>
<td>...</td>
<td>1</td>
<td>(reserved)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>B12</td>
<td>INTERNAL_INTERLOCK</td>
<td>1</td>
<td>Motor par. typed and no prev. of unexpected start-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>B13</td>
<td></td>
<td>1</td>
<td>(reserved)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>B14</td>
<td></td>
<td>1</td>
<td>(reserved)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>B15</td>
<td></td>
<td>1</td>
<td>(reserved)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Unit:** type: I, Min: -32768, Max: 32767, Integer scaling:
# Chapter 4 – Signals

<table>
<thead>
<tr>
<th>Group name:</th>
<th>STATUS WORDS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>02</strong></td>
<td>AUX STATUS WORD (ASW)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Bit</th>
<th>Description</th>
<th>Bit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B0</td>
<td>LOGG_DATA_READY</td>
<td>Drive specific auxiliary status word</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B1</td>
<td>OUT_OF_WINDOW</td>
<td>Content of data logger is readable.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B2</td>
<td>EMERG_STOP_COAST</td>
<td>Actual speed is outside of the defined window.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B3</td>
<td>MAGNETIZED</td>
<td>Emergency stop function has failed.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B4</td>
<td>RUN_DISABLED</td>
<td>A flux has been formed in the motor.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B5</td>
<td>SYNC_RDY</td>
<td>External interlocking (DI2) prevents the run.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B6</td>
<td>1_START_NOT_DONE</td>
<td>Position counter synchronous ready status.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B7</td>
<td>IDENTIF_RUN_DONE</td>
<td>Not started after the setting of Group 99.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B8</td>
<td>START_INHIBITION</td>
<td>Motor Identification run has been completed.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B9</td>
<td>LIMITING</td>
<td>Prevention of unexpected start-up is active.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B10</td>
<td>TORQ_CONTROL</td>
<td>Control at a limit. (See signals 8.03-8.04).</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B11</td>
<td>ZERO_SPEED</td>
<td>Drive is torque controlled.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B12</td>
<td>INTERNAL_SPEED_FB</td>
<td>Motor actual speed is below the zero speed limit.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B13</td>
<td>M_F_COMM_ERR_ASW</td>
<td>Internal speed feedback selected.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B14</td>
<td>USER_MACRO_1</td>
<td>CH2 Master/Follower link break.</td>
</tr>
<tr>
<td></td>
<td>AUX STATUS WORD (ASW)</td>
<td>B15</td>
<td>USER_MACRO_2</td>
<td>User macro 1 activated.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>unit:</th>
<th>type: I</th>
<th>Min: -32768</th>
<th>Max: 32767</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Bit</th>
<th>Description</th>
<th>Bit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B0</td>
<td>TORQ_MOTOR_LIM</td>
<td>POWER MOTING LIMIT is active.</td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B1</td>
<td>SPC_TORQ_MIN_LIM</td>
<td>POWER GENERATING LIMIT is active.</td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B2</td>
<td>SPC_TORQ_MAX_LIM</td>
<td>(reserved)</td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B3</td>
<td>TORQ_USER_CUR_LIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B4</td>
<td>TORQ_INV_CUR_LIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B5</td>
<td>TORQ_MIN_LIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B6</td>
<td>TORQ_MAX_LIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B7</td>
<td>TREF_TORQ_MIN_LIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B8</td>
<td>TREF_TORQ_MAX_LIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B9</td>
<td>FLUX_MIN_LIMIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B10</td>
<td>FREQ_MIN_LIMIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B11</td>
<td>FREQ_MAX_LIMIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B12</td>
<td>DC_UNDERVOLT_LIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B13</td>
<td>DC_OVERVOLT_LIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B14</td>
<td>TORQUE_LIMIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 1</td>
<td>B15</td>
<td>FREQ_LIMIT</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>unit:</th>
<th>type: I</th>
<th>Min: -32768</th>
<th>Max: 32767</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Bit</th>
<th>Description</th>
<th>Bit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LIMIT WORD 2</td>
<td>B0</td>
<td>P_MOT_LIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 2</td>
<td>B1</td>
<td>P_GEN_LIM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT WORD 2</td>
<td>B2...15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>unit:</th>
<th>type: I</th>
<th>Min: -32768</th>
<th>Max: 32767</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index</td>
<td>Description</td>
<td>Value</td>
<td>Type</td>
<td>Min</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>-------</td>
<td>------</td>
<td>-----</td>
</tr>
<tr>
<td>05</td>
<td>Bit</td>
<td></td>
<td>I</td>
<td>-32768</td>
</tr>
<tr>
<td>06</td>
<td>Bit</td>
<td></td>
<td>I</td>
<td>-32768</td>
</tr>
</tbody>
</table>

### DI STATUS WORD

**Group name:** STATUS WORDS  
**Interval:** 10 ms

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Value</th>
<th>Type</th>
<th>Min</th>
<th>Max</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>05</td>
<td>Bit</td>
<td></td>
<td>I</td>
<td>-32768</td>
<td>32767</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>Bit</td>
<td></td>
<td>I</td>
<td>-32768</td>
<td>32767</td>
<td></td>
</tr>
</tbody>
</table>

### AUX STATUS WORD 2

**Group name:** STATUS WORDS  
**Interval:** 10 ms

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Value</th>
<th>Type</th>
<th>Min</th>
<th>Max</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>05</td>
<td>Bit</td>
<td></td>
<td>I</td>
<td>-32768</td>
<td>32767</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>Bit</td>
<td></td>
<td>I</td>
<td>-32768</td>
<td>32767</td>
<td></td>
</tr>
</tbody>
</table>

If NDIO I/O Extension Modules are installed, see also Parameters 98.03...98.05 and Chapter 4 - I/O Configuration, Digital Inputs.
### Group 9 Fault Words

<table>
<thead>
<tr>
<th>9</th>
<th>Group name: FAULT WORDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description: Fault signals of the drive.</td>
</tr>
</tbody>
</table>

#### FAULT WORD 1

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>SHORT CIRC</td>
<td>Short circuit in the main circuit.</td>
</tr>
<tr>
<td>B1</td>
<td>OVERCURRENT</td>
<td>Overcurrent.</td>
</tr>
<tr>
<td>B3</td>
<td>ACS 600 TEMP</td>
<td>Power plate overtemperature.</td>
</tr>
<tr>
<td>B4</td>
<td>EARTH FAULT</td>
<td>Earth fault.</td>
</tr>
<tr>
<td>B5</td>
<td>MOTOR TEMP M</td>
<td>Motor overtemperature (measured).</td>
</tr>
<tr>
<td>B6</td>
<td>MOTOR TEMP</td>
<td>Motor overtemperature (calculated).</td>
</tr>
<tr>
<td>B7</td>
<td>SYSTEM_FAULT</td>
<td>A fault is indicated by the System Fault Word 9.03.</td>
</tr>
<tr>
<td>B8</td>
<td>UNDERLOAD</td>
<td>Underload fault. See parameter 30.16.</td>
</tr>
<tr>
<td>B9</td>
<td>OVERFREQ</td>
<td>Overspeed fault.</td>
</tr>
<tr>
<td>B10</td>
<td></td>
<td>(reserved)</td>
</tr>
<tr>
<td>B11</td>
<td>CH2 COM LOS</td>
<td>CH2 Master/Follower communication fault.</td>
</tr>
<tr>
<td>B12</td>
<td>SC (INU1)</td>
<td>short circuit in parallel connected INU 1.</td>
</tr>
<tr>
<td>B13</td>
<td>SC (INU2)</td>
<td>short circuit in parallel connected INU 2.</td>
</tr>
<tr>
<td>B14</td>
<td>SC (INU3)</td>
<td>short circuit in parallel connected INU 3.</td>
</tr>
<tr>
<td>B15</td>
<td>SC (INU4)</td>
<td>short circuit in parallel connected INU 4.</td>
</tr>
</tbody>
</table>

#### FAULT WORD 2

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>SUPPLY PHASE</td>
<td>High supply section ripple voltage.</td>
</tr>
<tr>
<td>B1</td>
<td>NO MOTOR DATA</td>
<td>No motor data entered in Group 99.</td>
</tr>
<tr>
<td>B3</td>
<td>CABLE TEMP</td>
<td>Motor cable overtemperature.</td>
</tr>
<tr>
<td>B4</td>
<td>RUN DISABLED</td>
<td>External interlocking on DI2 active.</td>
</tr>
<tr>
<td>B5</td>
<td>ENCODER FLT</td>
<td>Speed measurement fault.</td>
</tr>
<tr>
<td>B6</td>
<td>I/O FAULT</td>
<td>I/O device fault on CH1.</td>
</tr>
<tr>
<td>B7</td>
<td>CABIN TEMP F</td>
<td>Drive cabinet overtemperature (meas. by NIOC-01)</td>
</tr>
<tr>
<td>B8</td>
<td></td>
<td>(reserved)</td>
</tr>
<tr>
<td>B9</td>
<td>OVER SWFREQ</td>
<td>Over switching frequency fault.</td>
</tr>
<tr>
<td>B10</td>
<td>AI&lt;MIN FUNC</td>
<td>Current-type input below 4 mA on AI2 or AI3.</td>
</tr>
<tr>
<td>B11</td>
<td>PPCC LINK</td>
<td>NINT board current measurement or comm. fault.</td>
</tr>
<tr>
<td>B12</td>
<td>CH0 COM LOS</td>
<td>Communication break on CH0.</td>
</tr>
<tr>
<td>B13</td>
<td>PANEL LOST</td>
<td>Local control lost.</td>
</tr>
<tr>
<td>B14</td>
<td>MOTOR STALL</td>
<td>Motor stalled.</td>
</tr>
<tr>
<td>B15</td>
<td>MOTOR PHASE</td>
<td>Motor circuit fault.</td>
</tr>
</tbody>
</table>

unit: type: I Min: -32768 Max: 32767 Integer scaling:
### Fault Words

#### System Fault Word

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Factory default parameter file error.</td>
<td>B0 FLT (F1_7)</td>
</tr>
<tr>
<td>01</td>
<td>User macro file error.</td>
<td>B1 USER MACRO</td>
</tr>
<tr>
<td>02</td>
<td>FPROM operating error.</td>
<td>B2 FLT (F1_4)</td>
</tr>
<tr>
<td>03</td>
<td>FPROM data error.</td>
<td>B3 FLT (F1_5)</td>
</tr>
<tr>
<td>04</td>
<td>Internal time level T2 overflow (100µs).</td>
<td>B4 FLT (F2_12)</td>
</tr>
<tr>
<td>05</td>
<td>Internal time level T3 overflow (1ms).</td>
<td>B5 FLT (F2_13)</td>
</tr>
<tr>
<td>06</td>
<td>Internal time level T4 overflow (50ms).</td>
<td>B6 FLT (F2_14)</td>
</tr>
<tr>
<td>07</td>
<td>Internal time level T5 overflow (1s).</td>
<td>B7 FLT (F2_15)</td>
</tr>
<tr>
<td>08</td>
<td>State machine overflow.</td>
<td>B8 FLT (F2_16)</td>
</tr>
<tr>
<td>09</td>
<td>Application program execution error.</td>
<td>B9 FLT (F2_17)</td>
</tr>
<tr>
<td>10</td>
<td>Application program execution error.</td>
<td>B10 FLT (F2_18)</td>
</tr>
<tr>
<td>11</td>
<td>Illegal instruction.</td>
<td>B11 FLT (F2_19)</td>
</tr>
<tr>
<td>12</td>
<td>Register stack overflow.</td>
<td>B12 FLT (F2_3)</td>
</tr>
<tr>
<td>13</td>
<td>System stack overflow.</td>
<td>B13 FLT (F2_1)</td>
</tr>
<tr>
<td>14</td>
<td>System stack underflow.</td>
<td>B14 FLT (F2_0)</td>
</tr>
</tbody>
</table>

#### Alarm Word 1

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Prevention of unexpected start-up active.</td>
<td>B0 START INHIBI</td>
</tr>
<tr>
<td>01</td>
<td>Emergency stop function has been activated DI1=0.</td>
<td>B1 EM STOP</td>
</tr>
<tr>
<td>02</td>
<td>Motor overtemperature (measured).</td>
<td>B2 MOTOR TEMP M</td>
</tr>
<tr>
<td>03</td>
<td>Overtemperature alarm of the thermal model.</td>
<td>B3 MOTOR TEMP</td>
</tr>
<tr>
<td>04</td>
<td>Power plate temperature.</td>
<td>B4 ACS 600 TEMP</td>
</tr>
<tr>
<td>05</td>
<td>Pulse encoder error.</td>
<td>B5 ENCODER ERR</td>
</tr>
<tr>
<td>06</td>
<td>Temperature measurement failure.</td>
<td>B6 T MEAS ALM</td>
</tr>
<tr>
<td>07</td>
<td>Basic digital I/O alarm (NIOC-01).</td>
<td>B7 DIO ALARM</td>
</tr>
<tr>
<td>08</td>
<td>Basic analogue I/O alarm (NIOC-01).</td>
<td>B8 AIO ALARM</td>
</tr>
<tr>
<td>09</td>
<td>External digital I/O alarm (NDIO).</td>
<td>B9 EXT DIO ALM</td>
</tr>
<tr>
<td>10</td>
<td>External analogue I/O alarm (NAIO).</td>
<td>B10 EXT AIO ALM</td>
</tr>
<tr>
<td>11</td>
<td>CH2 Master/Follower communication error.</td>
<td>B11 CH2 COM LOS</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>B12</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>B13</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>B14</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>B15</td>
</tr>
</tbody>
</table>

#### Unit, Type, Min, Max, Integer Scaling

- **Unit**: Type: I
- **Min**: -32768
- **Max**: 32767
- **Integer scaling**: 0
### Chapter 4 – Signals

#### FAULT WORDS

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>05</td>
<td>FAULT WORDS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interval: 500 ms</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>MOTOR FAN</td>
</tr>
<tr>
<td>B1</td>
<td>UNDERLOAD</td>
</tr>
<tr>
<td>B2</td>
<td>INV OVERLOAD</td>
</tr>
<tr>
<td>B3</td>
<td>CABLE TEMP</td>
</tr>
<tr>
<td>B4</td>
<td>(not in use)</td>
</tr>
<tr>
<td>B5</td>
<td>(not in use)</td>
</tr>
<tr>
<td>B6</td>
<td>(not in use)</td>
</tr>
<tr>
<td>B7</td>
<td>POwmFAIL FILE</td>
</tr>
<tr>
<td>B8</td>
<td>POWDOWN FILE</td>
</tr>
<tr>
<td>B9</td>
<td>MOTOR STALL</td>
</tr>
<tr>
<td>B10</td>
<td>Al&lt;MIN FUNC</td>
</tr>
<tr>
<td>B11</td>
<td>CH0 TIMEOUT</td>
</tr>
<tr>
<td>B12</td>
<td>(not in use)</td>
</tr>
<tr>
<td>B13</td>
<td>PANEL LOST</td>
</tr>
<tr>
<td>B14</td>
<td>DC UNDERVOLT</td>
</tr>
<tr>
<td>B15</td>
<td>RESTARTED</td>
</tr>
</tbody>
</table>

**Alarm Words 2**

- Acknowledge not received from ext. motor fan circ.
- Underload.
- Inverter overloading cycle $I_{\text{ac 10/60 s}}$, time elapsed.
- Motor cable overtemperature.
- Motor stalling.
- Current-type input below 4 mA on Al2 or Al3.
- Error in restoring 'powerfail.ddf'.
- Error in restoring 'powerdown.ddf'.
- Motor stalling.
- DDCS communication time-out on CH0.
- DC undervoltage indication during the Auto Restart.
- Motor has been restarted after the net break, if Auto Restart function enabled (see par. 21.09).

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>06</td>
<td>FAULT WORDS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interval: 500 ms</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>MOTOR FAN</td>
</tr>
<tr>
<td>B1</td>
<td>START INHIBIT HW</td>
</tr>
<tr>
<td>B2</td>
<td>SAFETY SWITC</td>
</tr>
<tr>
<td>B3</td>
<td>LINE CONV ERR</td>
</tr>
<tr>
<td>B4</td>
<td></td>
</tr>
<tr>
<td>B5</td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td></td>
</tr>
<tr>
<td>B7</td>
<td></td>
</tr>
<tr>
<td>B8</td>
<td></td>
</tr>
<tr>
<td>B9</td>
<td></td>
</tr>
<tr>
<td>B10</td>
<td></td>
</tr>
<tr>
<td>B11</td>
<td></td>
</tr>
<tr>
<td>B12</td>
<td></td>
</tr>
<tr>
<td>B13</td>
<td></td>
</tr>
<tr>
<td>B14</td>
<td></td>
</tr>
<tr>
<td>B15</td>
<td></td>
</tr>
</tbody>
</table>

**Fault Word 3**

- Acknowledge not received from ext. motor fan circ.
- Failure in Prevention of unexpected start-up circuit.
- Safety Switch fault.
- Lineconverter fault. Used in ACS611 or ACS617.
### Chapter 4 – Signals

#### FAULT WORDS

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>07</td>
<td><strong>INT FAULT INFO</strong></td>
</tr>
</tbody>
</table>

This Word includes collected information on the location of faults PPCC LINK, OVERCURRENT, EARTH FAULT and SHORT CIRCUIT. The bits 0…4 indicate the source of the active fault and bits b6…b11 give detailed information on a short circuit.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>NINT 1 FAULT</td>
<td>NINT 1 board fault *</td>
</tr>
<tr>
<td>B1</td>
<td>NINT 2 FAULT</td>
<td>NINT 2 board fault *</td>
</tr>
<tr>
<td>B2</td>
<td>NINT 3 FAULT</td>
<td>NINT 3 board fault *</td>
</tr>
<tr>
<td>B3</td>
<td>NINT 4 FAULT</td>
<td>NINT 4 board fault *</td>
</tr>
<tr>
<td>B4</td>
<td>NPBU FAULT</td>
<td>NPBU board fault * (Branching Unit board)</td>
</tr>
<tr>
<td>B5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td>U-PH SC U</td>
<td>Phase U upper-leg IGBT(s) short circuit</td>
</tr>
<tr>
<td>B7</td>
<td>U-PH SC L</td>
<td>Phase U lower-leg IGBT(s) short circuit</td>
</tr>
<tr>
<td>B8</td>
<td>V-PH SC U</td>
<td>Phase V upper-leg IGBT(s) short circuit</td>
</tr>
<tr>
<td>B9</td>
<td>V-PH SC L</td>
<td>Phase V lower-leg IGBT(s) short circuit</td>
</tr>
<tr>
<td>B10</td>
<td>W-PH SC U</td>
<td>Phase W upper-leg IGBT(s) short circuit</td>
</tr>
<tr>
<td>B11</td>
<td>W-PH SC L</td>
<td>Phase W lower-leg IGBT(s) short circuit</td>
</tr>
<tr>
<td>B12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* In use only with parallel inverters. NINT 0 is connected to NPBU CH1, NINT 1 to CH2 etc.

---

![Inverter Block Diagram](image1)

**Inverter Block Diagram**

- **NAMC**: Application and Motor Control Board
- **NINT**: Main Circuit Interface Board
- **NPBU**: PCS Link Branching Unit

---

![Inverter Unit Block Diagram](image2)

**Inverter Unit Block Diagram (two to four parallel Inverters)**

---

ACS 600 Firmware Manual, System Application Program 6.x 4 - 17
Chapter 5 – Parameters

Overview

This chapter explains the function of, and valid selections for, each parameter.

Parameter Groups

The parameters are arranged into groups by their function. The figure below illustrates the organisation of the parameter groups.

ACS 600 Parameters

<table>
<thead>
<tr>
<th>Group + Index</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.01...10.08</td>
<td>Start/Stop/Dir</td>
<td>8</td>
</tr>
<tr>
<td>11.01</td>
<td>I/O Reference select</td>
<td>1</td>
</tr>
<tr>
<td>13.01...13.14</td>
<td>Analogue Inputs</td>
<td>14</td>
</tr>
<tr>
<td>14.01...14.12</td>
<td>Digital Outputs</td>
<td>12</td>
</tr>
<tr>
<td>15.01...15.22</td>
<td>Analogue Outputs</td>
<td>22</td>
</tr>
<tr>
<td>16.01...16.06</td>
<td>System Control Inputs</td>
<td>6</td>
</tr>
<tr>
<td>17.01...17.03</td>
<td>DC Hold</td>
<td>3</td>
</tr>
<tr>
<td>18.01...18.02</td>
<td>LED Panel Control</td>
<td>2</td>
</tr>
<tr>
<td>19.01...19.08</td>
<td>Data Storage</td>
<td>8</td>
</tr>
<tr>
<td>20.01...20.18</td>
<td>Limits</td>
<td>18</td>
</tr>
<tr>
<td>21.01...21.11</td>
<td>Start/Stop Functions</td>
<td>11</td>
</tr>
<tr>
<td>22.01...22.08</td>
<td>Accel/Decel</td>
<td>8</td>
</tr>
<tr>
<td>23.01...23.11</td>
<td>Speed Reference</td>
<td>11</td>
</tr>
<tr>
<td>24.01...24.20</td>
<td>Speed Control</td>
<td>20</td>
</tr>
<tr>
<td>25.01...25.07</td>
<td>Torque Reference</td>
<td>7</td>
</tr>
<tr>
<td>26.01...26.07</td>
<td>Torque Reference Handling</td>
<td>7</td>
</tr>
<tr>
<td>27.01...27.08</td>
<td>Flux Control</td>
<td>8</td>
</tr>
<tr>
<td>28.01...28.10</td>
<td>Motor Model</td>
<td>11</td>
</tr>
<tr>
<td>29.01...29.04</td>
<td>Scalar Control</td>
<td>4</td>
</tr>
<tr>
<td>30.01...30.32</td>
<td>Fault Functions</td>
<td>32</td>
</tr>
<tr>
<td>31.01...31.02</td>
<td>Fault Functions</td>
<td>2</td>
</tr>
<tr>
<td>35.01...35.04</td>
<td>Motor Fan Control</td>
<td>4</td>
</tr>
<tr>
<td>36.01...36.02</td>
<td>Motor Cable</td>
<td>2</td>
</tr>
<tr>
<td>50.01...50.14</td>
<td>Speed Measurement</td>
<td>14</td>
</tr>
<tr>
<td>51.01...51.15</td>
<td>Master Adapter</td>
<td>15</td>
</tr>
<tr>
<td>70.01...70.20</td>
<td>DDCS Control</td>
<td>20</td>
</tr>
<tr>
<td>71.01...71.05</td>
<td>DriveBus Communication</td>
<td>1</td>
</tr>
<tr>
<td>90.01...90.18</td>
<td>Data Set Receive Addresses</td>
<td>18</td>
</tr>
<tr>
<td>91.01...91.06</td>
<td>Data Set Receive Addresses</td>
<td>6</td>
</tr>
<tr>
<td>92.01...92.18</td>
<td>Data Set Transmit Addresses</td>
<td>18</td>
</tr>
<tr>
<td>93.01...93.06</td>
<td>Data Set Transmit Addresses</td>
<td>6</td>
</tr>
<tr>
<td>97.01</td>
<td>Drive</td>
<td>1</td>
</tr>
<tr>
<td>98.01...98.07</td>
<td>Option Modules</td>
<td>7</td>
</tr>
<tr>
<td>99.01...99.13</td>
<td>Start-Up Data</td>
<td>13</td>
</tr>
</tbody>
</table>

Total 340
How to Read the Parameter Table

Before you start to read the parameter table, we first recommend you read this description.

- Parameter change by DriveWindow or the CDP 312 is stored to FPROM memory; changes made by the overriding system are only stored to RAM.

- If the overriding control system reads or writes individual bits of a word with an Advant CONV_IB element, (for example AUX CONTROL WORD 7.02) the bit B15 corresponds to the SIGN outputs of the element.

- From DriveWindow and the control panel, parameter values are set in decimal.

- Unit of the parameter value can be seen on the lower left-hand corner of the parameter description.

- Minimum, maximum and default values are shown in decimal format.

- Data type is given with a short code:
  I = 16-bit signed integer value   B = Boolean value
  PB = Packed Boolean value       R = Real value

- Communication between the overriding system and the drive uses 16 bit integer values (-32768...32767). To change a parameter value from the overriding system, an integer value for the parameter must be calculated using the information given in the Integer scaling column.

**Example 1:** If TREF TORQMAX (real) is set from the overriding system, an integer value of 100 corresponds to 1 % (see below).

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Maximum torque reference as a percentage of the motor nominal torque.</th>
</tr>
</thead>
<tbody>
<tr>
<td>09</td>
<td>TREF TORQMAX</td>
<td>Min: 0 %  Max: 300 %  Def: 300 %  Integer scaling: 100 == 1%</td>
</tr>
</tbody>
</table>

**Figure 5 - 1 Sample of the Parameter Table**

**Example 2:** Speed reference from the overriding system.

- Speed reference input is given by Parameter 23.01 SPEED REF. The Integer scaling box reads “see Par. 50.01”. Parameter 50.01 defines the motor speed (in rpm) at maximum reference (20000 for the overriding system). Thus, sending a value of 20000 from the overriding system into Parameter 23.01 sets the speed reference to the rpm value given with Parameter 50.01.
### Group 10 Start/Stop/Dir

<table>
<thead>
<tr>
<th>10</th>
<th>Group name: DIGITAL INPUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description: This parameter group defines the functions for digital inputs.</td>
</tr>
</tbody>
</table>

#### 01 START/STOP

<table>
<thead>
<tr>
<th>Index</th>
<th>Description: Digital input for Start/Stop command, when I/O control has been activated either by changing Parameter 98.02 COMM MODULE to NO or HAND is selected using the options at Parameter 10.07 HAND/AUTO.</th>
</tr>
</thead>
</table>
| 1     | 1 = NO  
2 = DI3 Start by rising edge (0->1), 0 = stop  
3 = DI4 Start by rising edge (0->1), 0 = stop  
4 = DI5 Start by rising edge (0->1), 0 = stop  
5 = DI6 Start by rising edge (0->1), 0 = stop  
6 = EXT2 DI1 Start by rising edge (0->1), 0 = stop, NDIO I/O extension module 2. Parameter 98.04 DI/O EXT MODULE 2 must be set to value EXTEND.  
7 = EXT2 DI2 Start by rising edge (0->1), 0 = stop, NDIO I/O extension module 2. Parameter 98.04 DI/O EXT MODULE 2 must be set to value EXTEND. |

<table>
<thead>
<tr>
<th>Unit:</th>
<th>type: I</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
</table>

#### 02 DIRECTION

<table>
<thead>
<tr>
<th>Index</th>
<th>Description: This parameter allows fixing the direction of rotation of motor to FORWARD or REVERSE, if unipolar speed reference has been selected in I/O control by Parameter 13.12 MINIMUM AI1. Note: I/O control is activated either by setting Parameter 98.02 COMM MODULE to value NO or HAND is selected using the options at Parameter 10.07 HAND/AUTO.</th>
</tr>
</thead>
</table>
| 1     | 1 = FORWARD  
2 = DI3 1 = reverse, 0 = forward  
3 = DI4 1 = reverse, 0 = forward  
4 = DI5 1 = reverse, 0 = forward  
5 = DI6 1 = reverse, 0 = forward  
6 = EXT2 DI1 1 = reverse, 0 = forward, NDIO I/O extension module 2. Parameter 98.04 DI/O EXT MODULE 2 must be set to EXTEND.  
7 = EXT2 DI2 1 = reverse, 0 = forward, NDIO I/O extension module 2. Parameter 98.04 DI/O EXT MODULE 2 must be set to EXTEND. |

<table>
<thead>
<tr>
<th>Unit:</th>
<th>type: I</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
</table>

#### 03 RESET

<table>
<thead>
<tr>
<th>Index</th>
<th>Description: Digital input for Reset function, when I/O control has been activated either by changing Parameter 98.02 COMM MODULE to value NO or HAND is selected using the options at Parameter 10.07 HAND/AUTO.</th>
</tr>
</thead>
</table>
| 1     | 1 = NO  
2 = DI3 Reset by rising edge (0->1).  
3 = DI4 Reset by rising edge (0->1).  
4 = DI5 Reset by rising edge (0->1).  
5 = DI6 Reset by rising edge (0->1).  
6 = EXT2 DI1 Reset by rising edge, NDIO I/O extension module 2. Parameter 98.04 DI/O EXT MODULE 2 must be set to value EXTEND.  
7 = EXT2 DI2 Reset by rising edge, NDIO I/O extension module 2. Parameter 98.04 DI/O EXT MODULE 2 must be set to value EXTEND. |

<table>
<thead>
<tr>
<th>Unit:</th>
<th>type: I</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
</table>
## DIGITAL INPUTS

### 04 - SYNC CMD

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Digital input for SYNC COMMAND for the positioning count. This is a faster alternative for synchronising by (7.02) ACW bit 9. Active in all control modes.</td>
<td>1 = NO (default), 2, 3, 4, 5, 6, 7 = various inputs</td>
</tr>
<tr>
<td>2</td>
<td>Digital input for motor overtemperature protection. Input for thermal switch (KLIXON) or thermistor relay can be selected freely, but the PTC-sensor is connected only to D16 of the I/O board NIOC-01. See Chapter 2 “Motor protections”.</td>
<td>1 = NO (default), 2, 3, 4, 5, 6, 7 = various inputs</td>
</tr>
</tbody>
</table>

### 05 - KLIXON

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Digital input for motor overtemperature protection. Input for thermal switch (KLIXON) or thermistor relay can be selected freely, but the PTC-sensor is connected only to D16 of the I/O board NIOC-01. See Chapter 2 “Motor protections”.</td>
<td>1 = NO (default), 2, 3, 4, 5, 6, 7 = various inputs</td>
</tr>
<tr>
<td>2</td>
<td>Digital input for motor overtemperature protection. Input for thermal switch (KLIXON) or thermistor relay can be selected freely, but the PTC-sensor is connected only to D16 of the I/O board NIOC-01. See Chapter 2 “Motor protections”.</td>
<td>1 = NO (default), 2, 3, 4, 5, 6, 7 = various inputs</td>
</tr>
</tbody>
</table>

### 06 - MOTOR FAN ACK

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Selection of the acknowledge source for motor fan diagnostics. An acknowledge signal indicates, that the contactor of the fan motor is closed. See Parameter Group 35.</td>
<td>1 = NO (default), 2, 3, 4, 5, 6, 7 = various inputs</td>
</tr>
</tbody>
</table>

Parameter 98.04 DI/O EXT MODULE 2 must be set to value EXTEND.
### DIGITAL INPUTS

#### 07 HAND/AUTO

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Selections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = NO</td>
<td>Digital input for switching between HAND control (I/O) and AUTO (through overriding system) control. This selection has a higher priority than Parameter 98.02 COMM MODULE.</td>
<td>(default)</td>
</tr>
<tr>
<td>2 = DI3</td>
<td>High = HAND, low = AUTO</td>
<td></td>
</tr>
<tr>
<td>3 = DI4</td>
<td>High = HAND, low = AUTO</td>
<td></td>
</tr>
<tr>
<td>4 = DI5</td>
<td>High = HAND, low = AUTO</td>
<td></td>
</tr>
<tr>
<td>5 = DI6</td>
<td>High = HAND, low = AUTO</td>
<td></td>
</tr>
<tr>
<td>6 = EXT2 DI1</td>
<td>High = HAND, low = AUTO, NDIO I/O extension module 2. Parameter 98.04 DI/O EXT MODULE 2 must be set to value EXTEND.</td>
<td></td>
</tr>
<tr>
<td>7 = EXT2 DI2</td>
<td>High = HAND, low = AUTO, NDIO I/O extension module 2. Parameter 98.04 DI/O EXT MODULE 2 must be set to value EXTEND.</td>
<td></td>
</tr>
</tbody>
</table>

#### 08 START INHIB DI

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Selections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = NO</td>
<td>Digital input for the Prevention of Unexpected Start-Up function. Selected digital input acts as an AND type interlocking with bit 3 (RUN) of Main Control Word. See Chapter 7. See the START INHIB HW fault diagnostics.</td>
<td>(default)</td>
</tr>
<tr>
<td>2 = DI3</td>
<td>High = Prevention of Unexpected Start-Up circuit is OFF, low = ON</td>
<td></td>
</tr>
<tr>
<td>3 = DI4</td>
<td>High = Prevention of Unexpected Start-Up circuit is OFF, low = ON</td>
<td></td>
</tr>
<tr>
<td>4 = DI5</td>
<td>High = Prevention of Unexpected Start-Up circuit is OFF, low = ON</td>
<td></td>
</tr>
<tr>
<td>5 = DI6</td>
<td>High = Prevention of Unexpected Start-Up circuit is OFF, low = ON</td>
<td></td>
</tr>
<tr>
<td>6 = EXT2 DI1</td>
<td>High = Prevention of Unexpected Start-Up circuit is OFF, low = ON, NDIO I/O extension module 2. Parameter 98.04 DI/O EXT MODULE 2 must be set to value EXTEND.</td>
<td></td>
</tr>
<tr>
<td>7 = EXT2 DI2</td>
<td>High = Prevention of Unexpected Start-Up circuit is OFF, low = ON, NDIO I/O extension module 2. Parameter 98.04 DI/O EXT MODULE 2 must be set to value EXTEND.</td>
<td></td>
</tr>
</tbody>
</table>

#### 08 SAFETY SWITCH

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Selections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = NO</td>
<td>Digital input for motor safety switch. The status of the safety switch is indicated in drive diagnostics either faulting, if the switch was opened during run or by alarming, if the drive was already stopped.</td>
<td>(default)</td>
</tr>
<tr>
<td>2 = DI3</td>
<td>High = OK, low = TRIP</td>
<td></td>
</tr>
<tr>
<td>3 = DI4</td>
<td>High = OK, low = TRIP</td>
<td></td>
</tr>
<tr>
<td>4 = DI5</td>
<td>High = OK, low = TRIP</td>
<td></td>
</tr>
<tr>
<td>5 = DI6</td>
<td>High = OK, low = TRIP</td>
<td></td>
</tr>
<tr>
<td>6 = EXT2 DI1</td>
<td>High = OK, low = TRIP, NDIO I/O extension module 2. Parameter 98.04 DI/O EXT MODULE 2 must be set to value EXTEND.</td>
<td></td>
</tr>
<tr>
<td>7 = EXT2 DI2</td>
<td>High = OK, low = TRIP, NDIO I/O extension module 2. Parameter 98.04 DI/O EXT MODULE 2 must be set to value EXTEND.</td>
<td></td>
</tr>
</tbody>
</table>
### Chapter 5 – Parameters

**Group 11 Reference Select**

<table>
<thead>
<tr>
<th>11</th>
<th>Group name:</th>
<th>REFERENCE SELECT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description:</td>
<td>This parameter group is visible only when 98.02 COMM MODULE is set to NO or HAND mode is selected by parameter 10.07 HAND/AUTO, i.e. the drive is controlled through its I/O connections. When the drive is controlled by the overriding system, Group 11 parameters are ineffective. See also configuration figure of Parameter 98.06.</td>
</tr>
</tbody>
</table>

#### 01 EXT REF1 SELECT

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
<th>EXT REF1 is a speed reference given via analogue input. There are two alternatives available for the NIOC-01 board.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 = STD AI1</td>
<td>0...10 V speed reference input</td>
</tr>
<tr>
<td></td>
<td>2 = STD AI2</td>
<td>0(4)...20 mA speed reference input</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>unit:</th>
<th>type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**Group 13 Analogue Inputs**

<table>
<thead>
<tr>
<th>13</th>
<th>Group name:</th>
<th>ANALOGUE INPUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>

#### 01 AI1 HIGH VALUE

| Index | Description: | This value corresponds to the maximum input voltage on AI1 produced by the device used. With I/O control, value 20000 corresponds to the speed defined by Parameter 50.01 SPEED SCALING. This parameter is not active when AI1 is used for motor 1 temperature measurement. See Parameter 30.03 MOT1 TEMP AI1 SEL. |

<table>
<thead>
<tr>
<th>unit:</th>
<th>type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-32768</td>
<td>32767</td>
<td>20000</td>
<td></td>
</tr>
</tbody>
</table>

#### 02 AI1 LOW VALUE

| Index | Description: | This value corresponds to the minimum input voltage on AI1. With I/O control, it defines the minimum speed. If bipolar I/O reference is used, value -20000 corresponds the maximum negative speed based on Parameter 50.01 SPEED SCALING. This parameter is not active when AI1 is used for motor 1 temperature measurement. See Parameter 30.03 MOT1 TEMP AI1 SEL. |

<table>
<thead>
<tr>
<th>unit:</th>
<th>type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-32768</td>
<td>32767</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

#### 03 FILTER AI1

| Index | Description: | Filter time constant for analogue input AI1. The hardware filter time constant is 20 ms. |

<table>
<thead>
<tr>
<th>unit:</th>
<th>type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 ms</td>
<td>30000 ms</td>
<td>1000 ms</td>
<td></td>
</tr>
</tbody>
</table>

#### 04 AI2 HIGH VALUE

| Index | Description: | This value corresponds to the maximum input in milliamperes (20 mA). This parameter is not active when used for motor 2 temperature measurement. See parameter 30.06 MOT2 TEMP AI2 SEL. |

<table>
<thead>
<tr>
<th>unit:</th>
<th>type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-32768</td>
<td>32767</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

#### 05 AI2 LOW VALUE

| Index | Description: | This value corresponds to the minimum input in milliamperes (0 or 4 mA). This parameter is not active when used for motor 2 temperature measurement. See parameter 30.06 MOT2 TEMP AI2 SEL. |

<table>
<thead>
<tr>
<th>unit:</th>
<th>type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-32768</td>
<td>32767</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

#### 06 MINIMUM AI2

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
<th>Minimum value of AI2. This value corresponds to the minimum reference.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 = 0 mA</td>
<td>(0...20 mA)</td>
</tr>
<tr>
<td></td>
<td>2 = 4 mA</td>
<td>(4...20 mA)</td>
</tr>
<tr>
<td></td>
<td>3 = -20 mA</td>
<td>(Used with bipolar type of analogue input)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>unit:</th>
<th>type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

#### 07 FILTER AI2

| Index | Description: | Filter time constant for analogue input AI2. The hardware filter time constant is 20 ms. |

<table>
<thead>
<tr>
<th>unit:</th>
<th>type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 ms</td>
<td>30000 ms</td>
<td>1000 ms</td>
<td></td>
</tr>
</tbody>
</table>
### Chapter 5 – Parameters

#### Group 13 Analogue Inputs

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>Description:</th>
<th>unit:</th>
<th>type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td>08</td>
<td>ANALOGUE INPUTS</td>
<td>This value corresponds to the maximum input in milliamperes (20 mA).</td>
<td></td>
<td></td>
<td>-32768</td>
<td>32767</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>09</td>
<td></td>
<td>This value corresponds to the minimum input in milliamperes (0 or 4 mA).</td>
<td></td>
<td></td>
<td>-32768</td>
<td>32767</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>MINIMUM AI3</td>
<td>Minimum value of AI3. This value corresponds to the minimum reference.</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>FILTER AI3</td>
<td>Filter time constant for analogue input AI3. The hardware filter time constant is 20 ms.</td>
<td>ms</td>
<td>R</td>
<td>0</td>
<td>30000</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>MINIMUM AI1</td>
<td>Minimum value of AI1. This value corresponds to the minimum reference.</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>NBIO/NIOB AI1 GAIN</td>
<td>Analogue input AI1 hardware gain selection for NBIO-21 or NIOB-01 board.</td>
<td></td>
<td></td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>NBIO/NIOB AI2 GAIN</td>
<td>Analogue input AI2 hardware gain selection for NBIO-21 or NIOB-01 board.</td>
<td></td>
<td></td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Group 14 Digital Outputs

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>Description:</th>
<th>unit:</th>
<th>type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>DIGITAL OUTPUTS</td>
<td>Control of the digital outputs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>DO1 CONTROL</td>
<td>An emergency stop command energises DO1 until MAIN CONTROL WORD bit 0 is set to a 0 state and zero speed has been detected. If the emergency stop function is not activated (by Parameter 21.04), the output can be controlled from the overriding system.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td></td>
<td>Digital output 1 is controlled by a selectable (see Par. 14.03) bit of the signal selected with this parameter. The format is (-)xyy, where (-) = inversion, x = Group, yy = Index. Examples: If Parameters 14.02 and 14.03 are set to 801 and 1 respectively (default), digital output DO1 is active when 8.01 MAIN STATUS WORD bit 1 (READY) 14.02 and 14.03 are set to --801 and 3 respectively, digital output DO1 is active when 8.01 MAIN STATUS WORD bit 3 (TRIPPED) is 0. If this parameter is set to 0, digital output DO1 is controlled by the overriding system (7.02 AUX CTRL WORD bit 13).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td></td>
<td>Digital output 1 is controlled by a selectable (see Par. 14.03) bit of the signal selected with this parameter. The format is (-)xyy, where (-) = inversion, x = Group, yy = Index. Examples: If Parameters 14.02 and 14.03 are set to 801 and 1 respectively (default), digital output DO1 is active when 8.01 MAIN STATUS WORD bit 1 (READY) 14.02 and 14.03 are set to --801 and 3 respectively, digital output DO1 is active when 8.01 MAIN STATUS WORD bit 3 (TRIPPED) is 0. If this parameter is set to 0, digital output DO1 is controlled by the overriding system (7.02 AUX CTRL WORD bit 13).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Chapter 5 – Parameters

<table>
<thead>
<tr>
<th></th>
<th>Group name:</th>
<th>Description:</th>
<th>Type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td><strong>DIGITAL OUTPUTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>DO1 BIT NUMBER</td>
<td>This parameter specifies the bit number for the signal selected at Parameter 14.02.</td>
<td>I</td>
<td>0</td>
<td>23</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>DO2 GROUP+INDEX</td>
<td>Digital output 2 control. See parameter 14.02. If this parameter is set to 0, digital output DO2 is controlled by the overriding system (7.02 AUX CTRL WORD bit 14). See also Par. 14.12 DO2 GRP+INDEX MOD.</td>
<td>I</td>
<td>-30000</td>
<td>30000</td>
<td>801</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>DO2 BIT NUMBER</td>
<td>This parameter specifies the bit number for the signal selected at Parameter 14.04</td>
<td>I</td>
<td>0</td>
<td>23</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>DO3 GROUP+INDEX</td>
<td>Digital output 3 control. See parameter 14.02. If this parameter is set to 0, digital output DO3 is controlled by the overriding system (7.02 AUX CTRL WORD bit 15).</td>
<td>I</td>
<td>-30000</td>
<td>30000</td>
<td>801</td>
<td></td>
</tr>
<tr>
<td>07</td>
<td>DO3 BIT NUMBER</td>
<td>This parameter specifies the bit number for the signal selected at Parameter 14.06</td>
<td>I</td>
<td>0</td>
<td>23</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>08</td>
<td>EXT2 DO1 GR+INDEX</td>
<td>Extension module 2 digital output DO1 control. See parameter 14.02. If this parameter is set to 0, digital output DI1 can be controlled by the overriding system (7.03 AUX CTRL WORD 2 bit 2). To activate this extension module see Parameter 98.04.</td>
<td>I</td>
<td>-30000</td>
<td>30000</td>
<td>801</td>
<td></td>
</tr>
<tr>
<td>09</td>
<td>EXT2 DO1 BIT NR</td>
<td>(not available with NAMC-03/04)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>EXT2 DO2 GR+INDEX</td>
<td>Extension module 2 digital output DO2 control. See parameter 14.02. If this parameter is set to 0, digital output can be controlled by the overriding system (7.03 AUX CTRL WORD 2 bit 3). To activate this extension module see Parameter 98.04.</td>
<td>I</td>
<td>-30000</td>
<td>30000</td>
<td>806</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>EXT2 DO2 BIT NR</td>
<td>(not available with NAMC-03/04)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>DO2 GRP+INDEX MOD</td>
<td>(not available with NAMC-03/04)</td>
<td>B</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**0 = REM/LOCAL**

**1 = LOCAL**

### DO2 GRP+INDEX MOD

This parameter defines the DO2 control in LOCAL and REMOTE modes.

- **0 = REM/LOCAL**
  - DO2 Group + Index parametrisation with Par. 14.04 and 14.05 affects in REMOTE and LOCAL mode.
- **1 = LOCAL**
  - DO2 Group + Index parametrisation is effective only in LOCAL mode. In the REMOTE mode, signal 7.02 ACW bit 14 controls DO2.

**Unit:** B

**Min:** 0

**Max:** 1

**Def:** 0

**Integer scaling:** 1 == 1
## Group 15 Analogue Outputs

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Unit</th>
<th>Type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>ANALOGUE OUTPUT 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>INVERT AO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>MINIMUM AO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>FILTER AO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>SCALE AO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>ANALOGUE OUTPUT 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 01 ANALOGUE OUTPUT 1
- **Description:** To direct a measured signal to analogue output AO1, set this parameter according to the format (x)xyy. Where (x) is the group and yy the index of the desired signal; eg. 2301 denotes Par. 23.01.
- A signal from the overriding system can also control the analogue output. The data set in which the signal is transmitted to the drive is directed into one of the DATA parameters (19.01...19.08) using Parameters 90.01...91.18. The DATA parameter is then coupled to the analogue output with this parameter.
- If temperature measurement (Parameter 30.03) is selected, analogue output AO1 is used for supplying a constant current for the sensor.

### 02 INVERT AO1
- **Description:** Analogue output AO1 signal inversion.
  - 0 = NO minimum signal value corresponds to the minimum output value.
  - 1 = YES maximum signal value corresponds to the minimum output value.

### 03 MINIMUM AO1
- **Description:** Analogue output 1 signal offset in milliamperes. This parameter is not effective if motor 1 temperature measurement is activated by Parameter 30.03. Otherwise, the following settings are available.
  - 1 = 0 mA
  - 2 = 4 mA
  - 3 = 10 mA 50% offset in the range 0...20 mA for testing or indication of direction (torque, speed etc.)

### 04 FILTER AO1
- **Description:** Filter time constant for analogue output AO1.

### 05 SCALE AO1
- **Description:** Nominal value of the analogue output AO1 signal which is selected in Parameter 15.01. This value corresponds to 20 mA at the output.

### 06 ANALOGUE OUTPUT 2
- **Description:** To direct a measured signal to analogue output AO1, set this parameter according to the format (x)xyy. Where (x) is the group and yy the index of the desired signal; eg. 1506 denotes Par. 15.06.
- A signal from the overriding system can also control the analogue output. The data set in which the signal is transmitted to the drive is directed into one of the DATA parameters (19.01...19.08) using Parameters 90.01...91.18. The DATA parameter is then coupled to the analogue output with this parameter.
- If temperature measurement (Parameter 30.06) is selected, analogue output AO2 is used for supplying a constant current for the sensor.
### Chapter 5 – Parameters

#### 07 INVERT AO2

**Group name:** ANALOGUE OUTPUTS  
**Description:** Analogue output AO2 signal inversion.  
0 = **NO** minimum signal value corresponds to the minimum output value.  
1 = **YES** maximum signal value corresponds to the minimum output value.  

<table>
<thead>
<tr>
<th>unit</th>
<th>type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td>NO</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>

#### 08 MINIMUM AO2

**Description:** Analogue output AO2 signal offset in milliamperes.  
1 = 0 mA  
2 = 4 mA  
3 = 10 mA 50% offset in the range of 0...20 mA for testing or indication of direction (torque, speed etc.).  

<table>
<thead>
<tr>
<th>unit</th>
<th>type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>100 == 1s</td>
</tr>
</tbody>
</table>

#### 09 FILTER AO2

**Description:** Filter time constant for analogue output AO2.  

<table>
<thead>
<tr>
<th>unit</th>
<th>type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>s</td>
<td>R</td>
<td>0 s</td>
<td>10 s</td>
<td>0.1 s</td>
<td>100 == 1s</td>
</tr>
</tbody>
</table>

#### 10 SCALE AO2

**Description:** Nominal value of analogue output AO2 signal which is selected in Parameter 15.06. This value corresponds to 20 mA at the output.  

<table>
<thead>
<tr>
<th>unit</th>
<th>type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>0</td>
<td>65536</td>
<td>3000</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>

#### 11 ANALOGUE OUTPUT 3

**Description:** Analogue Outputs AO3 and AO4 are available when a NAIO I/O extension is used and Parameter 98.06 is set to **UNIPOLAR AI** or **BIPOLAR AI**. See also the hardware connections at Parameter 98.06.  

This parameter selects the signal to be connected to analogue output AO3. See Parameter 15.01 ANALOGUE OUTPUT 1.  

<table>
<thead>
<tr>
<th>unit</th>
<th>type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>0</td>
<td>30000</td>
<td>101</td>
<td>100 == 1s</td>
</tr>
</tbody>
</table>

#### 12 INVERT AO3

**Description:** Analogue output AO3 signal inversion.  
0 = **NO** minimum signal value corresponds to the minimum output value.  
1 = **YES** maximum signal value corresponds to the minimum output value.  

<table>
<thead>
<tr>
<th>unit</th>
<th>type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td>NO</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>

#### 13 MINIMUM AO3

**Description:** Analogue output AO3 signal offset in milliamperes.  
1 = 0 mA  
2 = 4 mA  
3 = 10 mA 50% offset in the range of 0...20 mA for testing or indication of direction (torque, speed etc.).  
4 = 12 mA Used for 4...20 mA signal for meters which have zero point in the middle of the range (e.g. -1000…0…1000 rpm).  

<table>
<thead>
<tr>
<th>unit</th>
<th>type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>100 == 1s</td>
</tr>
</tbody>
</table>

#### 14 FILTER AO3

**Description:** Filter time constant for analogue output AO3.  

<table>
<thead>
<tr>
<th>unit</th>
<th>type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>s</td>
<td>R</td>
<td>0 s</td>
<td>10 s</td>
<td>0.1 s</td>
<td>100 == 1s</td>
</tr>
</tbody>
</table>

#### 15 SCALE AO3

**Description:** Nominal value of analogue output AO3 signal which is selected in Parameter 15.11. This value corresponds to 20 mA at the output.  

<table>
<thead>
<tr>
<th>unit</th>
<th>type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>0</td>
<td>65536</td>
<td>3000</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>
### Group name: ANALOGUE OUTPUTS

#### Parameter 15.01: ANALOGUE OUTPUT 4

**Index** 15  
**Group name:** ANALOGUE OUTPUTS

**Description:** Analogue Outputs AO3 and AO4 are available when a NAIO I/O extension is used and Parameter 98.06 is set to UNIPOLAR AI or BIPOLAR AI. See also the hardware connections at parameter 98.06.

<table>
<thead>
<tr>
<th>Signals for AO-outputs</th>
<th>AO3</th>
<th>AO4</th>
<th>Extension I/O module</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAIO-01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAIO-02</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This parameter selects the signal to be connected to analogue output AO4. See parameter 15.01 ANALOGUE OUTPUT 1.

**Index** 16  
**Description:** Analogue Outputs AO3 and AO4 are available when a NAIO I/O extension is used and Parameter 98.06 is set to UNIPOLAR AI or BIPOLAR AI. See also the hardware connections at parameter 98.06.

<table>
<thead>
<tr>
<th>Extension I/O module</th>
<th>AO1</th>
<th>AO2</th>
<th>mA</th>
</tr>
</thead>
</table>

#### Parameter 17: INVERT AO4

**Index** 17  
**Description:** Analogue output AO4 signal inversion.

0 = NO minimum signal value corresponds to the minimum output value.

1 = YES maximum signal value corresponds to the minimum output value.

**Index** 18  
**Description:** Analogue output AO4 signal offset in milliamperes.

1 = 0 mA

2 = 4 mA

3 = 10 mA 50% offset in the range of 0...20 mA for testing or indication of direction (torque, speed etc.)

4 = 12 mA Used for 4...20 mA signal for meters which have zero point in the middle of the range (e.g. –1000...0...1000 rpm)

#### Parameter 19: FILTER AO4

**Index** 19  
**Description:** Filter time constant for analogue output AO4.

**Index** 20  
**Description:** Nominal value of analogue output AO4 signal which is selected in Parameter 15.16. This value corresponds to 20 mA at the output.

#### Parameter 21: NBIO/NIOB AO1 MODE

**Index** 21  
**Description:** If NBIO-21 or NIOB-01 I/O board is selected as the Basic I/O board by Par. 98.07, it replaces NIOC-01 analogue outputs 1 and 2. NBIO-21 and NIOB-01 I/O boards have separate current and voltage output terminals. Note: MINIMUM AO1 has no function when –10V…0…+10V is selected.

Selection of the analogue output type is either current 0…20 mA or voltage –10V…0…+10V.

0 = 0…20mA

1 = –10V 0 +10V

#### Parameter 22: NBIO/NIOB AO2 MODE

**Index** 22  
**Description:** If NBIO-21 or NIOB-01 I/O board is selected as the Basic I/O board by Par. 98.07, it replaces NIOC-01 analogue outputs 1 and 2. NBIO-21 and NIOB-01 I/O boards have separate current and voltage output terminals. Note: MINIMUM AO2 has no function when –10V…0…+10V is selected.

Selection of the analogue output type is either current 0…20 mA or voltage –10V…0…+10V.

0 = 0…20mA

1 = –10V 0 +10V
### Chapter 5 – Parameters

#### Group 16 System Control Inputs

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Setting</th>
<th>Range</th>
<th>Default Value</th>
<th>Scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>RUN ENABLE</td>
<td>Digital Input DI2 dedicated for this input permanently. To activate the RUN ENABLE signal, voltage must be connected to digital input DI2. If the voltage drops to 0V, the drive coasts to stop and a run enable fault is generated.</td>
<td>2 = DI2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>PARAMETER LOCK</td>
<td>Prevents unauthorised changes by CDP 312 or DriveWindow Tool for Parameter Groups 0 ... 99. Parameter changes are disabled when LOCKED.</td>
<td>1 = LOCKED</td>
<td>Parameter changes are enabled when OPEN.</td>
<td>1 == 1</td>
</tr>
<tr>
<td>03</td>
<td>PASS CODE</td>
<td>This parameter enters the pass code for the Parameter Lock. The default value of this parameter is 0. In order to open the Parameter Lock, change the value to 358. After the Parameter Lock is opened, the value is automatically changed back to 0.</td>
<td>0 = OPEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>LOCAL LOCK</td>
<td>Control place change of the drive from remote to local can be disabled by setting this parameter to TRUE. If LOCAL LOCK is activated during local control, it takes effect only after the control place is changed back to remote.</td>
<td>0 = FALSE</td>
<td>Local control is disabled when TRUE.</td>
<td>1 == 1</td>
</tr>
<tr>
<td>05</td>
<td>USER MACRO CHG</td>
<td>User macro change by 7.03 AUX CONTROL WORD 2 bit 12 is enabled by means of this parameter. See also Parameter 99.11.</td>
<td>1 = NOT SEL Not selected.</td>
<td>Selection by ACW2 (7.03) bit 12 enabled.</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>PARAMETER BACKUP</td>
<td>Parameter save from the RAM memory to FPROM. This is needed only when parameter changes by overriding system have to be stored to FPROM memory instead of RAM.</td>
<td>0 = DONE Parameter value after the saving has been completed.</td>
<td>Parameter save to FPROM.</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>
### Group 17 DC Hold

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Unit</th>
<th>Type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>DC HOLD</td>
<td>rpm</td>
<td>B</td>
<td>0</td>
<td>5</td>
<td>NO</td>
<td>1 == 1</td>
</tr>
<tr>
<td>02</td>
<td>DC HOLD SPEED</td>
<td>rpm</td>
<td>R</td>
<td>0</td>
<td>3600</td>
<td>5</td>
<td>1 == 1</td>
</tr>
<tr>
<td>03</td>
<td>DC-HOLD CURRENT</td>
<td>%</td>
<td>R</td>
<td>0</td>
<td>100</td>
<td>30</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>

**01 DC HOLD**
- DC Hold is activated when both the speed reference and the actual speed drop below the defined DC HOLD SPEED. The drive will then stop generating sinusoidal current and inject DC current into the motor. The DC current value is set by the DC HOLD CURR parameter. When the speed reference rises above the DC HOLD SPEED, the DC current will be removed and normal operation resumed. This function is only possible in DTC control mode.
- 0 = NO DC HOLD is disabled
- 1 = YES DC HOLD is enabled

**02 DC HOLD SPEED**
- Sets the speed limit for the DC Hold function.

**03 DC-HOLD CURRENT**
- Sets the DC current to be applied to the motor when the DC Hold function is activated.
### Group 18 LED Panel Control

<table>
<thead>
<tr>
<th>18</th>
<th>Group name:</th>
<th>LED PANEL CTRL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description:</td>
<td>The NLMD-01 Monitoring Display has a 0...150% LED bar to show an absolute real type value. The source and the scale of this display signal is defined by this parameter group. <strong>Note:</strong> If NLMD -01 and CDP 312 control panel are used together, the first signal selected in the Actual Signal Display Mode of CDP 312 must be the default value 1.26 LED PANEL OUTP. Otherwise the NLMD-01 LED bar display will not show the correct value.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>01</th>
<th>Index</th>
<th>LED PANEL OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Interval 100 ms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description:</td>
<td>Signal group and index for the LED monitor display. The default value for this signal is 1.07 MOTOR TORQUE FILT.</td>
</tr>
<tr>
<td></td>
<td>unit: type: I</td>
<td>Min: 0 Max: 30000 Def: 107 Integer scaling:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>02</th>
<th>Index</th>
<th>SCALE PANEL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description:</td>
<td>The signal value (defined in Parameter 18.01) which corresponds to 100% on the LED bar display.</td>
</tr>
<tr>
<td></td>
<td>unit: type: R</td>
<td>Min: 0 Max: 65536 Def: 100 Integer scaling: 1 == 1</td>
</tr>
</tbody>
</table>
Group 19 Data Storage

This parameter group consists of unconnected parameters for linking, testing and commissioning purposes.

### Group 19 Data Storage

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Unit</th>
<th>Min</th>
<th>Max</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>A storage parameter for receiving from or sending to the overriding system. For example, if the signal from data set 18 word 3 (DW 18.3) is required for monitoring by DriveWindow, first set Parameter 90.15 DATA SET 18 VAL 3 to 1901 (denoting Par. 19.01), then select Parameter 19.01 DATA1 for the desired DriveWindow monitoring channel.</td>
<td>R</td>
<td>-32768</td>
<td>32767</td>
<td>1 == 1</td>
</tr>
<tr>
<td>02</td>
<td>See 19.01 DATA 1</td>
<td>R</td>
<td>-32768</td>
<td>32767</td>
<td>1 == 1</td>
</tr>
<tr>
<td>03</td>
<td>See 19.01 DATA 1</td>
<td>R</td>
<td>-32768</td>
<td>32767</td>
<td>1 == 1</td>
</tr>
<tr>
<td>04</td>
<td>See 19.01 DATA 1</td>
<td>R</td>
<td>-32768</td>
<td>32767</td>
<td>1 == 1</td>
</tr>
<tr>
<td>05</td>
<td>See 19.01 DATA 1</td>
<td>R</td>
<td>-32768</td>
<td>32767</td>
<td>1 == 1</td>
</tr>
<tr>
<td>06</td>
<td>See 19.01 DATA 1</td>
<td>R</td>
<td>-32768</td>
<td>32767</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>

Address of the Dataset 14 index 2 is 90.08. By setting parameter 90.08 to value 1901, the value A’ can be trended with the DriveWindow monitor tool.

Setting 92.08 to the value 1902 by a CDP 312 Control Panel or DriveWindow, it allows value being sent, for example gain value for tension regulator.
### Chapter 5 – Parameters

<table>
<thead>
<tr>
<th>19</th>
<th>Group name: DATA STORAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>07</td>
<td>Description: See 19.01 DATA 1</td>
</tr>
<tr>
<td>unit: type: R</td>
<td>Min: -32768 Max: 32767 Integer scaling: 1 == 1</td>
</tr>
</tbody>
</table>

| 08 | Description: See 19.01 DATA 1 |
| unit: type: R | Min: -32768 Max: 32767 Integer scaling: 1 == 1 |

### Group 20 Limits

<table>
<thead>
<tr>
<th>20</th>
<th>Group name: LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Description: This parameter group defines the maximum and minimum limits for the speed, frequency, current and torque algorithms. <strong>Note:</strong> The absolute nominal torque is calculated in the application program from the motor parameters (see Parameter Group 99).</td>
</tr>
<tr>
<td>unit: rpm type: R</td>
<td>Min: -18000 rpm Max: 18000rpm Def: See 99.05 Integer scaling: See 50.01</td>
</tr>
</tbody>
</table>

| 02 | Description: Positive speed reference limit in rpm. |
| unit: rpm type: R | Min: -18000 rpm Max: 18000rpm Def: See 99.05 Integer scaling: See 50.01 |

| 03 | Description: The absolute speed value at which the drive coasts after a stop command. |
| unit: rpm type: R | Min: 0 rpm Max: 15000rpm Def: 60 rpm Integer scaling: See 50.01 |

| 04 | Description: Maximum output current $I_{\text{max}}$, as a percentage of the drive. The maximum values are limited according to the duty cycle tables. There are two loading cycles defined: 10 s / 60 s and 1 min / 4 min. See the ACS 600 MultiDrive catalogue. |
| unit: % type: R | Min: 0 % Max: 200 % Def: 170 % Integer scaling: 100 == 1% |

| 05 | Description: Maximum positive output torque as a percentage of the motor nominal torque. |
| unit: % type: R | Min: 0 % Max: 300 % Def: 300 % Integer scaling: 100 == 1% |

| 06 | Description: Minimum negative output torque as a percentage of the motor nominal torque. |
| unit: % type: R | Min: -300 % Max: 0 % Def: -300 % Integer scaling: 100 == 1% |

| 07 | Description: Maximum speed controller output limit as a percentage of the motor nominal torque. |
| unit: % type: R | Min: 0 % Max: 600 % Def: 300 % Integer scaling: 100 == 1% |

| 08 | Description: Minimum speed controller output limit as a percentage of the motor nominal torque. |
| unit: % type: R | Min: -600 % Max: 0 % Def: -300 % Integer scaling: 100 == 1% |

| 09 | Description: Maximum torque reference as a percentage of the motor nominal torque. |
| unit: % type: R | Min: 0 % Max: 300 % Def: 300 % Integer scaling: 100 == 1% |

| 10 | Description: Minimum torque reference as a percentage of the motor nominal torque. |
| unit: % type: R | Min: -300 % Max: 0 % Def: -300 % Integer scaling: 100 == 1% |
### 20 FREQ TRIP MARGIN

**Index:** 11  
**Group name:** LIMITS  

**Description:** The purpose of this parameter is to protect the process against an overspeed condition. This parameter defines, together with parameters SPEEDMAX and SPEEDMIN (FREQ MAX and FREQ MIN in scalar control mode) the maximum allowed frequency of the drive. If this frequency is reached, an OVER SPEED FAULT is activated.

Example: If the maximum process speed is 1420 rpm (Parameter 20.01 SPEED MAX = 1420 rpm \(\approx 50 \text{ Hz}\)) and this parameter (20.11) is 10 Hz, the drive trips at 60 Hz.

- **unit:** Hz  
- **type:** R  
- **Min:** 0 Hz  
- **Max:** 500 Hz  
- **Def:** 50 Hz  
- **Integer scaling:** 100 \(= 1 \text{ Hz}\)

### 12 PULLOUT TCOEF MAX

**Index:** 12  

**Description:** Maximum torque limit from the calculated pull out torque. ACS 600 calculates the pull out torque value and limits the maximum motoring torque to prevent the pull out.

- **unit:** %  
- **type:** R  
- **Min:** 40 %  
- **Max:** 100%  
- **Def:** 70 %  
- **Integer scaling:** 1 \(= 1\)

### 13 PULLOUT TCOEF MIN

**Index:** 13  

**Description:** Minimum torque limit from the pull out torque without pulse encoder feedback mode. ACS 600 calculates pull out torque value and limits the maximum motor torque to prevent pull out effect.

- **unit:** %  
- **type:** R  
- **Min:** 0 %  
- **Max:** 100%  
- **Def:** 50 %  
- **Integer scaling:** 1 \(= 1\)

### 14 ADAPTIVE UDC MEAS

**Index:** 14  

**Description:** The adaptive DC voltage measurement function can be disabled by this parameter. This parameter is typically used in position OFF with undervoltage controller function to define similar operating point with undervoltage controllers between the drives connected to the same DC bus. 100% \(= 1.35 \times U_{1\text{max}}\).

When this parameter is ON, a DC voltage reference is floating according to network condition.

- **0 = OFF**  
- **1 = ON**

- **unit:** type: B  
- **Min:** 0  
- **Max:** 1  
- **Def:** 1  
- **Integer scaling:** 1 \(= 1\)
### Chapter 5 – Parameters

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>Component</th>
<th>Description</th>
<th>Index</th>
<th>Unit</th>
<th>Type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>LIMITS</td>
<td>UNDERVOLT TORQ UP</td>
<td>The undervoltage controller limiting value of maximum motor torque (%), when at nominal DC bus voltage.</td>
<td></td>
<td>%</td>
<td>R</td>
<td>0</td>
<td>600</td>
<td>500</td>
<td>10 == 1 %</td>
</tr>
<tr>
<td>16</td>
<td>Limites</td>
<td>UNDERVOLT TORQ DN</td>
<td>The undervoltage controller limiting value of the minimum torque (%) at undervoltage trip (60%) point. This parameter is used together with the undervoltage controller function to tune the generating torque level of the drive during the supply power failure. See figure at Par. 20.15.</td>
<td></td>
<td>%</td>
<td>R</td>
<td>-500</td>
<td>0</td>
<td>-125</td>
<td>-10 == -1 %</td>
</tr>
<tr>
<td>17</td>
<td>P MOTORING LIM</td>
<td>Maximum motoring power. 100% == motor nominal power.</td>
<td></td>
<td>%</td>
<td>R</td>
<td>0</td>
<td>600</td>
<td>300</td>
<td>100 == 1 %</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>P GENERATING LIM</td>
<td>Maximum generating power. 100% == motor nominal power.</td>
<td></td>
<td>%</td>
<td>R</td>
<td>-600</td>
<td>0</td>
<td>-300</td>
<td>100 == 1 %</td>
<td></td>
</tr>
</tbody>
</table>
### Group 21 Start/Stop Functions

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td><strong>START/STOP FUNC</strong></td>
<td>Group name: START/STOP FUNC</td>
</tr>
<tr>
<td>21</td>
<td>Description: Start and stop functions. <strong>Note:</strong> Coast stop is always the stop mode in a fault situation.</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td><strong>START FUNCTION</strong></td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>Description:</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>1 = AUTO</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>2 = DC MAGN</td>
<td>This setting is selected when starting to a rotating machine (Flying Start).</td>
</tr>
<tr>
<td>01</td>
<td>3 = CNST DCMAGN</td>
<td>If this setting is selected, a higher starting torque can be achieved. The optimal magnetising current is calculated on the basis of the motor parameters. The pre-magnetising time is calculated using the motor information.</td>
</tr>
<tr>
<td>03</td>
<td><strong>STOP FUNCTION</strong></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Description: Conditions during motor deceleration in the LOCAL and I/O control modes.</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>1 = STOP RAMPING</td>
<td>Stop by the deceleration ramp DECEL TIME (22.02)</td>
</tr>
<tr>
<td>03</td>
<td>2 = STOP TORQ</td>
<td>Stop by the torque limit.</td>
</tr>
<tr>
<td>03</td>
<td>3 = COAST STOP</td>
<td>Torque is zero.</td>
</tr>
<tr>
<td>04</td>
<td><strong>EME STOP MODE</strong></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>Description:</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>1 = STOP RAMPNG</td>
<td>Stop by the emergency stop ramp. See Parameter 22.04</td>
</tr>
<tr>
<td>04</td>
<td>2 = STOP TORQ</td>
<td>Stop by the torque limit.</td>
</tr>
<tr>
<td>04</td>
<td>3 = COAST STOP</td>
<td>Torque is zero.</td>
</tr>
<tr>
<td>04</td>
<td>4 = FOLLOW STOP</td>
<td>Emergency stop has no function to the torque selector. Thus it is possible to stop the follower drive by torque reference of the master drive.</td>
</tr>
<tr>
<td>05</td>
<td><strong>EMSTOP DER MAX L</strong></td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>Description: This parameter defines the maximum deceleration rate for emergency stop monitoring. See also Parameter 21.05 above. Using the default value disables the monitoring of minimum deceleration.</td>
<td></td>
</tr>
</tbody>
</table>

### Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td><strong>CONST MAGN TIME</strong></td>
</tr>
<tr>
<td>02</td>
<td>Unit: ms</td>
</tr>
<tr>
<td>02</td>
<td>Min: 30 ms</td>
</tr>
<tr>
<td>02</td>
<td>Def: 300 ms</td>
</tr>
</tbody>
</table>

**Warning!** The starting to a rotating machine is not possible when DC magnetising is selected. DC magnetising cannot be selected in the scalar mode.

### Start Jerk Comp.

**MOTOR RATED POWER**

- <10 kW: Constant Magnetising Time > 100 to 200 ms
- 10 to 200 kW: > 200 to 1000 ms
- 200 to 1000 kW: > 1000 to 2000 ms

**Warning!** The starting to a rotating machine is not possible when DC magnetising is selected. DC magnetising cannot be selected in the scalar mode.
## Chapter 5 – Parameters

### Group name: **START/STOP FUNC**

#### Parameter 06: EMSTOP DER MIN L

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>06</td>
<td>This parameter defines the minimum deceleration rate for emergency stop monitoring. The deceleration speed of the drive is supervised during an emergency stop condition. This supervision starts 5 seconds after the drive has received an emergency stop signal. If the drive is not able to decelerate within the window, whose minimum limit is defined by this parameter and maximum limit by parameter 21.06 EMSTOP DER MAX L, it is stopped by issuing a coast stop and setting 8.02 AUX CONTROL WORD bit 2 (EMERG_STOP_COAST) to 1. Using the default value disables the monitoring of maximum deceleration. Selected deceleration actual value can be monitored from the signal (2.12) dV/dt.</td>
</tr>
</tbody>
</table>

Parameter values:
- **Unit:** rpm/s
- **Type:** R
- **Min:** 0 rpm/s
- **Max:** 18000 rpm/s
- **Def:** 0 rpm/s
- **Integer scaling:** 1 == 1

#### Parameter 07: EMSTOP DEC MON DEL

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>07</td>
<td>This parameter defines the delay before the starting of deceleration monitoring in the emergency stop. See also Parameter 21.05 and 21.06 above.</td>
</tr>
</tbody>
</table>

Parameter values:
- **Unit:** s
- **Type:** R
- **Min:** 0 s
- **Max:** 100 s
- **Def:** 20 s
- **Integer scaling:** 10 == 1 s

#### Parameter 08: EM STOP TORQ RAMP

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>08</td>
<td>This parameter activates the torque limit ramping function at the beginning of an emergency stop. The purpose is to change direction of power smoothly and prevent a possible current peak in the incoming supply unit. This function is recommended for use with regenerative thyristor supply.</td>
</tr>
</tbody>
</table>

Parameter values:
- **Unit:** type: Min: 0 Max: 1 Def: 0 Integer scaling: 1 == 1
- **TRUE**
- **FALSE**

---

ACS 600 Firmware Manual, System Application Program 6.x
### Chapter 5 – Parameters

#### 09 Group name: START/STOP FUNC

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Unit</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>09</td>
<td>AUTO RESTART</td>
<td>B</td>
<td>0</td>
<td>1</td>
<td>OFF</td>
<td>1 == 1</td>
</tr>
<tr>
<td></td>
<td>An automatic restart using flying start after a short supply power failure (0…5 s) can be activated by this parameter. The MAIN STATUS WORD (MSW) is frozen if the DC voltage dips below 75 % and released again after restart. FAULT WORD 2 (FW2) bit 2 is masked if the drive detects an undervoltage fault, and alarm “DC UNDERVOLT” is generated. Note the HW requirements!</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 = OFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 = ON</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 10 Index

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTO RESTART TIME</td>
<td>S</td>
<td>0 s</td>
<td>5 s</td>
<td>5 s</td>
<td>10 == 1s</td>
</tr>
<tr>
<td>The maximum power failure duration for the auto restart function. This time also includes the charging delay of the inverters.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 11 Index

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>START JERK COMP</td>
<td>R</td>
<td>0 %</td>
<td>100 %</td>
<td>0 %</td>
<td>1 == 1 %</td>
</tr>
<tr>
<td>If the start mode is CONST DCMAGN, it is possible to use internal positioning control during the magnetising of the motor to minimise shaft movement. Find the setting that gives the smallest shaft movement. Setting this parameter to 0 disables the function.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Group 22 Ramp Functions

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Type</th>
<th>Unit</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>ACCELER TIME</td>
<td>R</td>
<td>s</td>
<td>0</td>
<td>1000</td>
<td>20</td>
<td>100 == 1 s</td>
</tr>
<tr>
<td>02</td>
<td>DECELER TIME</td>
<td>R</td>
<td>s</td>
<td>0</td>
<td>1000</td>
<td>20</td>
<td>100 == 1 s</td>
</tr>
<tr>
<td>03</td>
<td>ACC/DEC TIME SCLE</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>EME STOP RAMP</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
The ramp time function with previous software versions is defined from the zero speed to maximum speed.

**ACCELER TIME**
The time within the drive accelerates from zero speed to the speed defined by parameter **50.01 SPEED SCALING**. The maximum acceleration time is 1800 s defined together with parameter 22.03.

**DECELER TIME**
The time within the drive decelerates from the speed defined by parameter **50.01 SPEED SCALING** to zero speed. The maximum deceleration time is 1800 s defined together with parameter 22.03.

**ACC/DEC TIME SCLE**
Multiplier for ACCELER TIME and DECELER TIME parameters to expand the time.

**EME STOP RAMP**
If an emergency stop is activated and Parameter EME STOP MODE 21.04 = 1 (STOP BY RAMP), the drive will decelerate according to this parameter to zero speed.
### RAMP FUNCTIONS

#### SHAPE TIME

**Index**: 05  
**Group name**: RAMP FUNCTIONS  
**Description**: Speed reference softening time. This function is deactivated during an emergency stop condition.

<table>
<thead>
<tr>
<th>Unit: s</th>
<th>Type: R</th>
<th>Min: 0 s</th>
<th>Max: 1000 s</th>
<th>Def: 0 s</th>
<th>Integer scaling: 100 == 1 s</th>
</tr>
</thead>
</table>

#### VARIABLE SLOPE

**Index**: 06  
**Description**: This function is used to control the slope of the speed ramp during a speed reference change. The time t for step A is defined by Parameter 22.07 VAR SLOPE RATE, where t = updating interval time of the overriding system.  

A = speed reference change during the time t.  

1 = **ON** Variable slope is enabled; the slope rate is defined by Parameter 22.07 VARIABLE SLOPE RATE.  

0 = **OFF** Function is disabled.  

Example: The overriding system transmit interval time for the speed reference and the VAR SLOPE RATE value are equal. As a result, the shape of SPEED REF 3 is a straight line.

This function is active only in REMOTE mode.

#### VAR SLOPE RATE

**Index**: 07  
**Description**: This parameter defines speed ramp time t for the speed reference change A, when Parameter 22.06 VARIABLE SLOPE is ON. Set this parameter to the same value as the updating interval time of the overriding system.

<table>
<thead>
<tr>
<th>Unit: ms</th>
<th>Type: R</th>
<th>Min: 4.05 ms</th>
<th>Max: 30 000 ms</th>
<th>Def: 4.05 ms</th>
<th>Integer scaling: 1 == 1 ms</th>
</tr>
</thead>
</table>

#### BAL RAMP REF

**Index**: 08  
**Description**: The output of the speed ramp can be forced to the value defined by this parameter. The function is activated by setting 7.02 AUX CONTROL WORD bit 3 to 1.

| Unit: rpm  | Type: R | Min: See 20.01 | Max: See 20.02 | Def: 0 rpm | Integer scaling: See Par 50.01 |
## Group 23 Speed Reference

### Description:
Speed reference functions.

### SPEED REFERENCE CHAIN

**SPEED REF**

**GROUP NAME:** SPEED REF

**DESCRIPTION:** Main speed reference input for the speed control of the drive.

**INDEX:** 01

**DESCRIPTION:** Constant speed reference is activated from 7.01 MAIN CTRL WORD bit 8. See also MCW bits 4...6.

**INDEX:** 02

**DESCRIPTION:** Constant speed reference is activated from 7.01 MAIN CTRL WORD bit 9. See also MCW bits 4...6.

**INDEX:** 03
<table>
<thead>
<tr>
<th>Group name:</th>
<th>SPEED REF</th>
</tr>
</thead>
</table>

**23**

**Index**

| Description: | This parameter value can be added to the filtered reference value. Note: If the overriding system or NAMC application itself sends a reference value into this parameter, it must be set to zero before a stop command of the drive. |

| unit: rpm | type: R | Min: 99.05 | Max: 99.05 | Def: 0 rpm | Integer scaling: | See Par. 50.01 |

**04**

**Index**

| Description: | Speed reference share coefficient. |

| unit: % | type: R | Min: 0 % | Max: 400 % | Def: 100 % | Integer scaling: | 10 == 1% |

**05**

**Index**

| Description: | Speed reference and actual error filter time. |

| unit: ms | type: R | Min: 0 ms | Max: 999999 ms | Def: 0 ms | Integer scaling: | 1 == 1 ms |

**07**

**Index**

| Description: | 1 = ON Integrator of the speed controller is released when window control is on. 0 = OFF Integrator of the speed controller is blocked when window control is on. The idea of Window Control The idea of Window Control is to deactivate speed control as long as the speed deviation remains within the window set by Parameters 23.08 WINDOW WIDTH POS and 23.09 WINDOW WIDTH NEG. This allows the external torque reference to affect the process directly. For example, in Master/Follower drives, where the follower is torque controlled, window control is used to keep the speed deviation of the follower under control. The speed error output to the speed controller is zero, when speed error is within the window. If the load of the follower disappears due to a disturbance in the process, the speed error will be outside the window. The speed controller reacts and its output is added to the torque reference. Speed control (only with P-control) brings the speed to the value SPEED REF + WINDOW WIDTH, if not integrator used. Note the permanent error of the P-control. This function could be called overspeed or underspeed protection in the torque control mode. To activate the window control it must be set 26.01 TORQUE SELECTOR to value ADD and set ACW1 (7.02) bit 7 WINDOW CTRL to 1. |

| unit: type: B | Min: 0 | Max: 1 | Def: OFF | Integer scaling: | 1 == 1 |

**08**

**Index**

| Description: | Positive speed limit for the window control, when the calculated speed error is positive. Speed error = speed reference – speed actual. See also Par. 23.11. Note: Window width positive and negative is forced to zero, if SPEED REF + WINDOW WIDTH POS is > MAXIMUM SPEED or < MINIMUM SPEED. |

| unit: rpm | type: R | Min: 0 rpm | Max: 99.05 | Def: 0 rpm | Integer scaling: | See Par 50.01 |

**09**

**Index**

| Description: | Negative speed limit for the window control, when the calculated speed error is negative. The maximum limit is the absolute value of Parameter 23.08 WINDOW WIDTH POS. Note: Window width positive and negative is forced to zero, if SPEED REF + WINDOW WIDTH NEG is > MAXIMUM SPEED or < MINIMUM SPEED. |

| unit: rpm | type: R | Min: 0 | Max: 99.05 | Def: 0 rpm | Integer scaling: | See Par 50.01 |

**10**

**Index**

| Description: | An additional speed step can be given to the speed controller directly as an additive error input. Note: If the overriding system or NAMC application itself sends a reference value into this parameter, it must be set to zero before a stop command of the drive. |

| unit: rpm | type: R | Min: 20.01 | Max: 20.02 | Def: 0 rpm | Integer scaling: | See Par 50.01 |
Chapter 5 – Parameters

23 Group name: SPEED REF

<table>
<thead>
<tr>
<th>Index</th>
<th>Description: If this parameter is activated, the values of WINDOW WIDTH POS and WINDOW WIDTH NEG are calculated from the absolute value of the speed, not from the signed speed. Thus window width functions are symmetric for both directions of rotation. Parameter 23.09 WINDOW WIDTH NEG functions as WINDOW WIDTH OVERSPEED and 23.08 WINDOW WIDTH POS as WINDOW WIDTH UNDERSPEED.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>0 = OFF 1 = ON</td>
</tr>
<tr>
<td>unit:</td>
<td>type: B Min: 0 Max: 1 Def: 0 Integer scaling: 1 == 1</td>
</tr>
</tbody>
</table>

Group 24 Speed Control

24 Group name: SPEED CONTROL

<table>
<thead>
<tr>
<th>Index</th>
<th>Description: The speed controller is based on the PID algorithm, which continuous time is presented as follows:</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>$u(s) = KPS \left[ \left( bY_r(s) - Y(s) \right) + \left( \frac{1}{TIS} + \frac{T_d}{T_f s + 1} \right)e(s) \right]$</td>
</tr>
</tbody>
</table>

Variable $u$ is the output of the controller, $e$ is the speed error (difference between the actual and reference values).

The PID controller also has set point weighting. $y$ is the output; $Y_r$ is the set point; $u$ is the controller’s output.

01 Group name: PI TUNE

<table>
<thead>
<tr>
<th>Index</th>
<th>Description: This parameter activates automatic tuning for the speed controller which is based on the estimation of the mechanical time constant. Parameters 24.03 KPS, 24.09 TIS and 24.15 ACC COMP DER TIME are updated after the PI TUNE test.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>0 = OFF 1 = ON PI TUNE is activated.</td>
</tr>
<tr>
<td>unit:</td>
<td>type: B Min: Max: Def: OFF Integer scaling: 1 == 1</td>
</tr>
</tbody>
</table>
### Parameters

#### Group name: SPEED CONTROL

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>DROOP RATE</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>The amount of speed decrease caused by the load is determined by means of this parameter. A setting of 1% causes (with nominal torque reference) a 1% decrease in speed from the rated speed.</td>
<td>Min: 0 %  Max: 100 %  Def: 0 %  Integer scaling: 10 == 1%</td>
</tr>
</tbody>
</table>

#### Proportional Gain Parameter of the Speed Controller

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>KPS</td>
<td>type: R  Min: 0  Max: 250  Def: 10  Integer scaling: 100 == 1</td>
</tr>
<tr>
<td></td>
<td>Relative gain for the speed controller. If you select a value of 1, a 10% change in the error value (e.g. reference - actual value) causes also the speed controller output to change by 10%.</td>
<td></td>
</tr>
</tbody>
</table>

#### The Adaptive Speed Control as a Function of the Torque Reference

The adaptive gain of the speed controller is used to smooth out disturbances which are caused by low load and backlash. Moderate filtering of the speed error (Parameter 23.04) is typically not enough to tune the drive.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>KPS MIN</td>
<td>type: R  Min: 0  Max: 150  Def: 10  Integer scaling: 100 == 1</td>
</tr>
<tr>
<td></td>
<td>KPS MIN determines the proportional gain when the speed controller output is zero.</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>KPS WEAKPOINT</td>
<td>type: R  Min: 0 %  Max: see 20.05  Def: 0 %  Integer scaling: 100 == 1%</td>
</tr>
<tr>
<td></td>
<td>The value of the speed controller output where the gain is KPS</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>KPS WP FILT TIME</td>
<td>type: R  Min: 0 ms  Max: 999999 ms  Def: 100 ms  Integer scaling: 1 == 1 ms</td>
</tr>
<tr>
<td></td>
<td>The rate of change for the proportional gain can be softened by this parameter.</td>
<td></td>
</tr>
</tbody>
</table>
Set point weighting is a well known method in control engineering. In this method, the set point is weighted by a factor \( b < 1 \). This weighting is applied only to the P term. Integral and derivative terms have a normally weighted \((b=1)\) setpoint and speed error.

This kind of manipulation leads to a situation where, in a steady state, the P term is not zero. The controller output is still ‘right’ because the integral part compensates the P term error. Thus, in a steady state, the controller works normally; the integral term "sees" error caused by load and noise. In set point changes, however, the controller's overshoot can be reduced by weighting factor \( b \). Thus, good load rejection is not anymore related to huge overshoot. In applications where ramp following without time lag is necessary, acceleration compensation is the right tool.

There is no overshoot in a set point change when factor \( b \) is set correctly \((b<1)\). This results in the integral term’s energy compensating the error caused by the P term. For example, if \( y_r = 1 \) and \( b = 0.9 \), the P term set point is actually 0.9 which naturally causes a 10% error for the integral term handle.

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name: SPEED CONTROL</th>
<th>Description: Set Point Weighting is enabled by this parameter. The change over is smooth which enables the on-line changing of weighting.</th>
</tr>
</thead>
<tbody>
<tr>
<td>07</td>
<td>SET P WEIGHTING</td>
<td>( 0 = \text{OFF} ) \quad \text{SET POINT WEIGHTING is activated.} \ 1 = \text{ON} )</td>
</tr>
<tr>
<td></td>
<td>unit: B</td>
<td>type: B</td>
</tr>
<tr>
<td>08</td>
<td>SET POINT WEIGHT</td>
<td>Description: The value of the speed controller output, where the gain is KPS.</td>
</tr>
<tr>
<td></td>
<td>unit: %</td>
<td>type: R</td>
</tr>
</tbody>
</table>
### Integration Time Parameters of the Speed Controller

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>unit</th>
<th>type</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 TIS</td>
<td>Integration time for the speed controller. This defines the time within which the maximum output is achieved if a constant error value exists and the relative gain of the speed controller is 1.</td>
<td>s</td>
<td>R</td>
<td>0.01 s</td>
<td>1000 s</td>
<td>2.5 s</td>
<td>1000 == 1s</td>
</tr>
<tr>
<td>10 TIS INIT VALUE</td>
<td>Initial value of the integrator.</td>
<td>%</td>
<td>R</td>
<td>see 20.06</td>
<td>see 20.05</td>
<td>0 %</td>
<td>100 == 1%</td>
</tr>
<tr>
<td>11 BAL REF</td>
<td>External value to be forced to the output of the speed controller when 7.02 AUX CONTROL WORD bit 8 BAL_NCONT is 1.</td>
<td>%</td>
<td>R</td>
<td>see 20.06</td>
<td>see 20.05</td>
<td>0 %</td>
<td>100 == 1%</td>
</tr>
</tbody>
</table>

### Derivation Parameters of the Speed Controller

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>unit</th>
<th>type</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 DERIVATION TIME</td>
<td>Derivation time for speed controller. Defines the time within which the speed controller derives the error value before the output of the speed controller is changed. If this is set to zero, the controller works as a PI controller, otherwise as a PID controller.</td>
<td>ms</td>
<td>R</td>
<td>0 ms</td>
<td>10000 ms</td>
<td>0 ms</td>
<td>1 == 1 ms</td>
</tr>
<tr>
<td>13 DERIV FILT TIME</td>
<td>The derivation filter time constant.</td>
<td>ms</td>
<td>R</td>
<td>0 ms</td>
<td>999999 ms</td>
<td>8 ms</td>
<td>1 == 1 ms</td>
</tr>
</tbody>
</table>

### Acceleration Compensation Parameters

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>unit</th>
<th>type</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 ACC COMP DER TIME</td>
<td>Derivation time used during compensation of acceleration. In order to compensate inertia during acceleration, the derivative of the reference is added to the output of the speed controller. The function is deactivated by setting the parameter to 0.</td>
<td>s</td>
<td>R</td>
<td>0 s</td>
<td>1000 s</td>
<td>0 s</td>
<td>10 == 1s</td>
</tr>
<tr>
<td>15 ACC COMP FILT TIME</td>
<td>Acceleration compensation term filter coefficient.</td>
<td>ms</td>
<td>R</td>
<td>0 ms</td>
<td>999999 ms</td>
<td>8 ms</td>
<td>1 == 1 ms</td>
</tr>
<tr>
<td>16 SLIP GAIN</td>
<td>This parameter is effective only when the calculated internal speed is used as actual speed feedback. 100% means full slip compensation. 0% corresponds no slip compensation (the calculated speed equals to motor frequency).</td>
<td>%</td>
<td>R</td>
<td>0 %</td>
<td>400 %</td>
<td>100 %</td>
<td>1 == 1%</td>
</tr>
</tbody>
</table>
Adaptive Speed Control as Function of the Speed

The adaptive speed control as a function of speed

In certain applications it is useful to increase the relative gain and decrease the integration time at low speeds, which improves the performance of the speed control at low speeds. The linear increase and decrease of these parameters is started at the speed of KPS TIS MIN FREQ and ended at KPS TIS MAX FREQ. Changing the rate of relative gain and integration time is done by parameters KPS VAL MIN FREQ and TIS VAL MIN FREQ.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>unit: Hz</th>
<th>type: R</th>
<th>Min: 0 Hz</th>
<th>Max: 200 Hz</th>
<th>Def: 5 Hz</th>
<th>Integer scaling: 100 == 1 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>KPS TIS MIN FREQ Description: The minimum motor frequency limit above which the relative gain and integral time is defined by parameters KPS VAL MIN FREQ and TIS VAL MIN FREQ.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>unit: Hz type: R Min: 0 Hz Max: 200 Hz Def: 5 Hz Integer scaling: 100 == 1 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>KPS TIS MAX FREQ Description: The frequency point at which KPS and TIS become constant.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>KPS VAL MIN FREQ Description: Relative gain percentage of KPS at the speed defined by KPS TIS MIN FREQ.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>TIS VAL MIN FREQ Description: Relative integral time percentage of TIS at the speed defined by KPS TIS MIN FREQ.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Group 25 Torque Reference

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Input</th>
<th>Description</th>
<th>Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>TORQUE REF A</td>
<td></td>
<td>Torque reference. TORQUE REF A can be scaled by the parameter LOAD SHARE.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Note: This signal is reset (one shot) upon switching to I/O control. See the AUTO/HAND function.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>unit: % type: R Min: see 20.06 Max: see 20.05 Def: 0 % Integer scaling: 100 == 1%</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>TORQ REF A FTC</td>
<td></td>
<td>TORQUE REF A low pass filter time constant.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>unit: ms type: R Min: 0 ms Max: 60000 ms Def: 0 ms Integer scaling: 1 == 1 ms</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>LOAD SHARE</td>
<td></td>
<td>TORQ REF A scaling factor which scales the external torque reference to a required level.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>unit: % type: R Min: -400 % Max: 400 % Def: 100 % Integer scaling: 10 == 1%</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>TORQUE REF B</td>
<td></td>
<td>Torque reference. Torque reference B is ramped by the parameters TORQ RAMP UP TIME and TORQ RAMP DN TIME.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Note: This signal is reset (one shot) upon switching to overriding system control (par. 98.02 = FBA DS1 or FBA DS10). See the AUTO/HAND function.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>unit: % type: R Min: see 20.06 Max: see 20.05 Def: 0 % Integer scaling: 100 == 1%</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>TORQ RAMP UP</td>
<td></td>
<td>Torque reference B ramp time from 0 % to 100 %.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>unit: s type: R Min: 0 s Max: 120 s Def: 0 s Integer scaling: 100 == 1 s</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>TORQ RAMP DOWN</td>
<td></td>
<td>Torque reference B ramp time from 100 % to 0 %.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>unit: s type: R Min: 0 s Max: 120 s Def: 0 s Integer scaling: 100 == 1 s</td>
<td></td>
</tr>
<tr>
<td>07</td>
<td>TORQ ACT FILT TIME</td>
<td></td>
<td>Filter time constant for signal 1.07 MOTOR TORQFILT2 used for torque actual monitoring purposes.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>unit: ms type: R Min: 2 ms Max: 20000 ms Def: 100 ms Integer scaling: 1 == 1 ms</td>
<td></td>
</tr>
</tbody>
</table>
### Group 26 Torque Reference Handling

#### 26 Group name: **TORQ REF HANDLING**

**Description:**
The torque reference can be given from the speed reference chain (TORQ REF2) or from the torque reference chain (TORQ REF1) depending on the control mode. This group defines how to handle the reference after the torque selector block.

**Index 01**: 
**TORQUE SELECTOR**

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>1 = ZERO</th>
<th>Speed control</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 = SPEED</td>
<td>Speed control</td>
<td>2 = SPEED</td>
<td>Torque control</td>
</tr>
<tr>
<td>3 = TORQUE</td>
<td>Torque control</td>
<td>Note: To prevent the torque limitation in generating mode, keep the minimum torque limits &lt; 0 (zero) e.g. during fast deceleration in the positive speed direction.</td>
<td></td>
</tr>
<tr>
<td>4 = MINIMUM</td>
<td>Minimum control. The drive follows smaller value of the TORQ REF1 and TORQ REF2. However, if the speed error becomes negative the drive follows TORQ REF2 until the speed error becomes positive again (latch function). Thus the drive never accelerates uncontrolled if the load is lost in the torque control.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 = MAXIMUM</td>
<td>Maximum control. The drive follows bigger value of the TORQ REF1 and TORQ REF2. However if the speed error becomes positive the drive follows TORQ REF2 until the speed error becomes negative again (latch function). Thus the drive never accelerates uncontrolled if the load is lost in the torque control.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 = ADD</td>
<td>Add control. The output of the torque selector is a sum of the TORQ REF1 and TORQ REF2. When the Window Control is required, a bit 7 WINDOW_CTRL must be activated in the ACW2 (7.02).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Index 02**: 
**LOAD COMPENSATION**

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>unit:</th>
<th>type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Load compensation added to TORQ REF3. Note: If the overriding system or the NAMC application itself sends a reference value into this parameter, it must be set to zero before the stop command of the drive.</td>
<td>%</td>
<td>R</td>
<td>See 20.06</td>
<td>See 20.05</td>
<td>0 %</td>
<td>100 == 1 %</td>
</tr>
</tbody>
</table>
### Chapter 5 – Parameters

#### Group name: TORQ REF HANDLING

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Note</th>
<th>.unit:</th>
<th>Type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>TORQUE STEP</td>
<td>INPUT</td>
<td>%</td>
<td>R</td>
<td>See 20.06</td>
<td>See 20.05</td>
<td>0 %</td>
<td>100 == 1 %</td>
</tr>
</tbody>
</table>

#### 03 TORQUE STEP

**Description:**
Additional torque step added to TORQ REF4.

**Note:**
If the overriding system or the NAMC application itself sends a reference value into this parameter, it must be set to zero before the stop command of the drive.

#### Oscillation Compensation

**Description:**
TORSIONAL VIBRATION DAMPING

The filter uses the speed error as an input. The bandpass filter searches for certain frequencies and calculates a sine wave which is summed to the torque reference after the phase shift. The phase shift can be set to phase angles between 0-360 degrees.

Typically this function is needed to dampen the mechanical oscillations. The following three parameters also belong to this function.

- **0 = ON** function is enabled
- **1 = OFF** function is disabled

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>unit:</th>
<th>Type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>OSC COMPENSATION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 05 Oscillation Freq

**Description:**
OSCILLATION FREQ is the oscillation frequency (Hz). Oscillation frequency is determined by viewing the speed difference signal and the following equation:

\[ f = \frac{N_{\text{peaks}}}{T}, \]

where 

- \( N_{\text{peaks}} \) is the number of peaks in the time window \( T \) (seconds). For example, if we see 11 peaks in 1.5 seconds the frequency is \( f = \frac{11}{1.5} \approx 7.3 \) Hz.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>unit:</th>
<th>Type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td>05</td>
<td>OSCILLATION FREQ</td>
<td>Hz</td>
<td>R</td>
<td>0 Hz</td>
<td>60 Hz</td>
<td>31 Hz</td>
<td>100 == 1 Hz</td>
</tr>
</tbody>
</table>

#### 06 Oscillation Phase

**Description:**
Oscillation phase is the phase angle of the sine wave. The control algorithm produces a sine wave whose phase can be shifted by this parameter.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>unit:</th>
<th>Type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td>06</td>
<td>OSCILLATION PHASE</td>
<td>° deg</td>
<td>R</td>
<td>0 °</td>
<td>360 °</td>
<td>0 °</td>
<td>1 == 1.41 °</td>
</tr>
</tbody>
</table>

#### 07 Oscillation Gain

**Description:**
Oscillation gain determines how much the sine wave is amplified before it is summed to the speed error signal. Oscillation gain is scaled according to the speed controller gain so that changing the speed controller gain will not disturb the oscillation damping.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>unit:</th>
<th>Type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td>07</td>
<td>OSCILLATION GAIN</td>
<td>%</td>
<td>R</td>
<td>0 %</td>
<td>100 %</td>
<td>0 %</td>
<td>100 == 1 %</td>
</tr>
</tbody>
</table>

---

### Group 27 Flux Control

#### Group name: FLUX CONTROL

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>FLUX OPTIMIZATION</td>
</tr>
</tbody>
</table>

**Description:**
The motor flux can be optimised in order to minimise the motor losses and reduce motor noise. Flux optimisation is used in drives that usually operate below nominal load.

- **1 = YES** flux optimisation enabled.
- **0 = NO** flux optimisation disabled.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>unit:</th>
<th>Type:</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling:</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>FLUX OPTIMIZATION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 == 1</td>
</tr>
</tbody>
</table>
### Group name: FLUX CONTROL

#### 02 FLUX BRAKING

**Description:** The braking ability of the drive can be highly improved by utilising flux braking. During braking, the mechanical energy of the driven equipment has to be dissipated in the motor and inverter. By modifying the magnetising level of the motor, thermal losses can be increased and the motor can be stopped more effectively. This function can be used with the non-regenerative incoming sections.

![Diagram of flux braking](image)

*Selection of the flux braking function.*

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>YES Flux braking enabled.</td>
</tr>
<tr>
<td>0</td>
<td>NO Flux braking disabled.</td>
</tr>
</tbody>
</table>

**Unit:** type: B

<table>
<thead>
<tr>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>OFF</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>

#### 03 FLUX REF

**Description:** Flux reference value in percentage. This value is stored to FPROM memory when set by CDP 312 or Drive Window.

**Unit:** %

<table>
<thead>
<tr>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>see 27.05</td>
<td>100%</td>
<td>10 == 1%</td>
</tr>
</tbody>
</table>

#### 04 FLUX MAX

**Description:** Maximum limit of the flux percentage.

**Unit:** %

<table>
<thead>
<tr>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>140%</td>
<td>140%</td>
<td>10 == 1%</td>
</tr>
</tbody>
</table>

#### 05 FLUX MIN

**Description:** Minimum limit of the flux percentage.

**Unit:** %

<table>
<thead>
<tr>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>100%</td>
<td>25%</td>
<td>10 == 1%</td>
</tr>
</tbody>
</table>

#### 08 HEX FIELD WEAKEN

**Description:** This parameter selects whether motor flux is controlled along a circular or a hexagonal pattern in the field weakening area of the frequency range.

1 = ON Enabled

Motor flux is controlled along a circular pattern below the field weakening point (FWP, typically 50 or 60 Hz), and along a hexagonal pattern in the field weakening range. The applied pattern is changed gradually as the frequency increases from 100% to 120% of the FWP. Using the hexagonal flux pattern, maximum output voltage can be reached; the peak load capacity is higher than with the circular flux pattern but the continuous load capacity is lower in the frequency range of FWP to 1.6 x FWP, due to increased losses.

0 = OFF Disabled

ACS600 controls the motor flux in such a way that the rotating flux vector follows a circular pattern. This is the default value and ideal for most applications. However, when operated in the field weakening range, it is not possible to reach 100% output voltage. The peak load capacity of the drive is lower than with the full voltage.

**Unit:** type: B

<table>
<thead>
<tr>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>OFF</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>
## Group 28 Motor Model

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.01</td>
<td>ZER COEF1</td>
<td>This coefficient affects the sensitivity of the pull-out prevention within the generator quadrant, with the speed below 20% of nominal speed and the torque above 30%. This parameter is automatically set according to an estimation during the Motor ID run or first start-up and normally requires no alteration. If the motor is prone to pull out at low speeds within the generator quadrant, decrease the coefficient. If motor is unstable at zero speed, increase the coefficient.</td>
</tr>
<tr>
<td>28.02</td>
<td>ZER GAIN</td>
<td>This coefficient also affects the sensitivity of the pull-out prevention within the generator quadrant, but inversely to Parameter 28.01.</td>
</tr>
<tr>
<td>28.03</td>
<td>MOT COEF</td>
<td>This parameter affects the accuracy and linearity of the torque control at low frequencies (&lt;10%) within the motor quadrant, when the torque is &gt;30%. This parameter is essential in maximising breakaway torque, as well as the stability of torque above 100%. Decreasing the value improves the ability to reach the maximum allowed torque. Too low a value makes the motor prone to pull out at low frequencies within the motor quadrant.</td>
</tr>
<tr>
<td>28.04</td>
<td>GEN COEF</td>
<td>This parameter affects the stability of torque at low frequencies (&lt;30%) within the generator quadrant. A greater value results in a more stable torque, however increasing the susceptibility to pulling out at a particular operation point if torque is above 40%. Increasing this value is useful in straightening out vibration problems.</td>
</tr>
<tr>
<td>28.05</td>
<td>MG COEF</td>
<td>This parameter affects to the accuracy and linearity of the torque control at low frequencies and torque within all quadrants. This parameter has no effect when frequency is &gt;30% or torque is &gt;80%.</td>
</tr>
<tr>
<td>28.06</td>
<td>CABLE LENGTH</td>
<td>This is used only, if the motor power is below 10 kW and the cable is longer than 80 metres. Otherwise it is not advisable to change this parameter value. This parameter affects to the switching frequency at low frequency reference (&lt;20% of motor nominal).</td>
</tr>
<tr>
<td>28.07</td>
<td>LONG DISTANCE MOD</td>
<td>Long Distance Mode. This function is used to limit maximum voltage peaks in the motor circuit and to reduce the switching frequency of the inverter. This parameter is used as standard on 690 V inverter units; it can also be used when the motor cables are long. 1 = ON Long distance mode enabled. 0 = OFF Long distance mode disabled.</td>
</tr>
</tbody>
</table>
### Chapter 5 – Parameters

<table>
<thead>
<tr>
<th>Group name:</th>
<th>MOTOR MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>28</strong></td>
<td></td>
</tr>
<tr>
<td><strong>08</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Index</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>This coefficient affects the calculated rotor time constant according to the motor rating plate values. It is used if the nominal speed value of the motor rating plate does not correspond to the real speed. For example, if the real slip speed is 10% higher than the calculated slip speed stated on the motor rating plate, a coefficient value of 10% is set into this parameter. See also signal 3.06 TR. <strong>Note:</strong> This parameter is effective only if a pulse encoder is used.</td>
</tr>
<tr>
<td><strong>unit:</strong></td>
<td>%</td>
</tr>
<tr>
<td><strong>type:</strong></td>
<td>R</td>
</tr>
<tr>
<td><strong>Min:</strong></td>
<td>-60 %</td>
</tr>
<tr>
<td><strong>Max:</strong></td>
<td>200 %</td>
</tr>
<tr>
<td><strong>Def:</strong></td>
<td>0 %</td>
</tr>
<tr>
<td><strong>Integer scaling:</strong></td>
<td>1 == 1</td>
</tr>
</tbody>
</table>

| **09**     |             |
| **Index**  |             |
| **Description:** | RS INC1 and RS INC2 coefficient parameters together define a function, which affects the measured stator resistance value. By increasing the stator resistance value at low frequencies, it increases the pull-out limit. |
| **unit:** | % |
| **type:** | R |
| **Min:** | -60 % |
| **Max:** | 100 % |
| **Def:** | 25 % |
| **Integer scaling:** | 10 == 1 % |

| **10**     |             |
| **Index**  |             |
| **Description:** | This coefficient defines the coefficient value of the stator resistance at 1.25 * motor nominal frequency. See parameter RS INC1. |
| **unit:** | % |
| **type:** | R |
| **Min:** | -60 % |
| **Max:** | 100 % |
| **Def:** | 0 % |
| **Integer scaling:** | 10 == 1 % |

| **11**     |             |
| **Index**  |             |
| **Description:** | Determines the proportional gain that is used to correct the calculated current (lcalc) based on the measured current (lmeas): 
\[ l_{\text{calc}} = l_{\text{calc}}(-1) + \frac{\text{calc\_current\_corr}}{100} \times (l_{\text{meas}} - l_{\text{calc}}(-1)) \]. The default value (~ 100%) forces the calculated current to follow the measured current and there is no reason to reduce this parameter from 100%, if there is no interferences in current measurements. However, if instantaneous current readings are corrupted by current oscillations caused by long motor cables (or LC-filter), then the noise immunity can be greatly improved by decreasing this parameter. Normally 10% is a suitable value to make DTC work with long cables (without LONG DISTANCE MODE). This parameter has no effect when using scalar control. |
| **unit:** | % |
| **type:** | R |
| **Min:** | 5 % |
| **Max:** | 100 % |
| **Def:** | 100 % |
| **Integer scaling:** | 10 == 1 % |
### Group 29 Scalar Control

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
<th>Parameter 50.01 SPEED SCALING has only affect for scaling of the actual speed in the Scalar motor control mode.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Scalar control parameters can be seen in the Control Diagram.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The scalar control mode is recommended for multimotor drives when the number of motors connected to the ACS 600 is variable. Scalar control is also recommended when the nominal current of the motor is less than 1/6 of the nominal current of the inverter, or the inverter is used for test purposes with no motor connected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The motor identification Run, flying start, torque control, DC HOLD, motor phase loss check, and stall functions are disabled in the scalar control mode.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Index</th>
<th>Description:</th>
<th>Unit</th>
<th>Type</th>
<th>Min</th>
<th>Max</th>
<th>Default</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Reference (FREQUENCY REF)</td>
<td>01</td>
<td>This is an input for the frequency reference.</td>
<td>Hz</td>
<td>R</td>
<td>See 29.03</td>
<td>See 29.02</td>
<td>0</td>
<td>100 == 1 Hz</td>
</tr>
<tr>
<td>Frequency Maximum (FREQUENCY MAX)</td>
<td>02</td>
<td>Operating range maximum frequency. This parameter has an internal link to the parameter SPEED MAX; if SPEED MAX is changed, this parameter is changed accordingly by the application program.</td>
<td>Hz</td>
<td>R</td>
<td>See 29.03</td>
<td>300 Hz</td>
<td>See 20.01</td>
<td>100 == 1 Hz</td>
</tr>
<tr>
<td>Field Weakening Compensation (IR COMPENSATION)</td>
<td>04</td>
<td>This parameter sets the extra relative voltage that is fed to the motor at zero frequency. The range is 0...30% of motor nominal voltage.</td>
<td>%</td>
<td>R</td>
<td>0 %</td>
<td>30 %</td>
<td>0</td>
<td>100 == 1</td>
</tr>
</tbody>
</table>

![Diagram showing field weakening compensation](image)
Chapter 5 – Parameters

Figure 5 - 2 Scalar Control diagram
### Chapter 5 – Parameters

#### Group 30 Fault Functions

<table>
<thead>
<tr>
<th>30</th>
<th>Group name: FAULT FUNCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description:</td>
</tr>
</tbody>
</table>

| 01 | Index | Description: Motor thermal protection mode selection. The selections are based on the thermal model defined by the drive (DTC) or the user (USER MODE). Motor heat-up is calculated assuming a load curve.  
**Note:** Motor thermal model can only be used when one motor is connected to the output of the inverter.  
1 = **DTC** The drive defines the thermal model values during the Motor Identification Run. (See Parameter 99.06.)  
2 = **USER MODE** The user can define the thermal model values using Parameters 30.09…30.12 and 30.28…30.31. **Note:** Motor thermal model can only be used when one motor is connected to the output of the inverter.  
1 = **DTC** The drive defines the thermal model values during the Motor Identification Run. (See Parameter 99.06.)  
2 = **USER MODE** The user can define the thermal model values using Parameters 30.09…30.12 and 30.28…30.31.  
3 = USER MODE Above that, USER MODE is the only valid selection. |

| 02 | Index | Description: Operation in case of an overload based on the motor thermal model protection (par. 30.01).  
1 = **FAULT**  
2 = **WARNING**  
3 = **NO** No thermal model protection and feedback to the motor model. **Note:** PT100 or PTC measurement and monitoring is activated by Parameter 30.03 MOT1 TEMP AI1 SEL and 30.06 MOT2 TEMP AI2 SEL. |

| 03 | Index | Description: This parameter is used to activate an external motor temperature measurement circuit connected to analogue input AI1 with NIOC-01 and NBIO-21 I/O-boards. See par. 98.07 BASIC I/O BOARD.  
Analogue output AO1 supplies a constant current according to the selections shown below. The measurement circuit employs 1 to 3 PT100 sensors or PTC thermistors. See the circuit diagrams at Parameter 98.06.  
1 = **NOT IN USE** Analogue input AI1 is not in use for motor temperature measurement.  
2 = 1xPT100 One PT100 sensor; 9.1 mA current generator, (0…10V or 0…2V with NAIO-01, NAIO-02, NAIO-03 or NBIO-21 extension module.  
3 = 2xPT100 Two PT100 sensors; 9.1 mA current generator, 0…10V.  
4 = 3xPT100 Three PT100 sensors; 9.1 mA current generator, 0…10V.  
5 = 1...3 PTC 1 to 3 PTC thermistors or KTY84-xx silicon temperature sensor; 0.16 mA current generator, 0…10V. |

| 04 | Index | Description: Motor 1 temperature alarm is activated when the measured temperature rises above this limit. PT100 [°C], PTC (Ω). |

| 05 | Index | Description: Motor 1 temperature trip is activated when the measured temperature rises above this limit. PT100 [°C], PTC (Ω). |

---

ACS 600 Firmware Manual, System Application Program 6.x 5 - 39
Chapter 5 – Parameters

**30**  
Group name: **FAULT FUNCTIONS**

<table>
<thead>
<tr>
<th>Index:</th>
<th>Description:</th>
<th>Mot2 Temp AI2 Sel</th>
</tr>
</thead>
</table>
| 06     | This parameter is used to activate a second external motor temperature measurement circuit connected to NAIO I/O extension module or NBIO-21 I/O module, analogue input AI2. Analogue output AO2 supplies a constant current. The measurement circuit employs 1 to 3 PT100 sensors or PTC thermistors. See the circuit diagrams at Parameter 98.06.  
**Note:** Both measurement circuits (motor 1 and motor 2) have to be connected to the NAIO I/O extension module, if NIOC-01 exists.  
Not in use for motor temperature measurement (0...10V range).  
One PT100 temperature sensor (9.1 mA current gen., select 0...2V range by DIP switches in the NAIO extension module.)  
Two PT100 temperature sensors (9.1 mA current gen., 0...10V)  
Three PT100 temperature sensors (9.1 mA current gen., 0...10V)  
1...3 PTC thermistor or KTY84-xxsilicon temperature sensor; (1.6 mA current generator, 0...10V range). |

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
<th>Motor 2 temperature alarm is activated when the measured temperature rises above this limit. PT100 [°C], PTC (Ω)[°C].</th>
</tr>
</thead>
<tbody>
<tr>
<td>07</td>
<td>Motor 2 temperature alarm is activated when the measured temperature rises above this limit. PT100 [°C], PTC (Ω)[°C].</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motor 2 temperature trip is activated when the measured temperature rises above this limit. PT100 [°C], PTC (Ω)[°C].</td>
<td></td>
</tr>
</tbody>
</table>

**Motor Thermal Model User Mode**

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
<th>Motor Thermal Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>09</td>
<td>Time for 63% temperature rise. Used with the motor thermal model when parameter 30.01 MOT THERM P MODE is set to USER MODE. For monitoring of the calculated temperature, see signal 1.18 MOTOR TEMP EST. The USER MODE is only used when motor nominal current is &gt;800 A.</td>
<td></td>
</tr>
</tbody>
</table>

If thermal protection according to UL requirements for NEMA class motors is desired, the thermal time for a Class 10 trip curve is 350 s, for Class 20 trip curve 700 s and for a Class 30 trip curve 1050 s.  

![Motor Thermal Model User Mode](image-url)
Table 5 - 1  Motor Thermal Times for ABB HXR and AMA Motors.

<table>
<thead>
<tr>
<th>HXR motor type</th>
<th>Temp. rise time</th>
</tr>
</thead>
<tbody>
<tr>
<td>400S</td>
<td>2700 s</td>
</tr>
<tr>
<td>400L</td>
<td>3600 s</td>
</tr>
<tr>
<td>450L</td>
<td>4200 s</td>
</tr>
<tr>
<td>500L</td>
<td>4800 s</td>
</tr>
<tr>
<td>560L</td>
<td>6000 s</td>
</tr>
<tr>
<td>AMA motor type</td>
<td></td>
</tr>
<tr>
<td>all types</td>
<td>1500 s</td>
</tr>
</tbody>
</table>

Group name: FAULT FUNCTIONS

30.01 MOTOR LOAD CURVE

Index Description: The motor load curve sets the maximum allowable operating load of the motor. It is active when USER MODE is selected in Parameter 30.01 MOT THERM P MODE. When set to 100%, the maximum allowable load is equal to the value of Start-up Data Parameter 99.03 MOTOR NOM CURRENT. The load curve level should be adjusted if the ambient temperature differs from the nominal value.

99.02 MOTOR NOM CURRENT

Index Description: The maximum motor load at zero speed for the load curve. A higher value can be used if the motor has an external fan motor to boost the cooling when running the drive at a low frequency. See the motor manufacturer’s recommendations. This parameter is used when USER MODE is selected in parameter 30.01 MOT THERM P MODE.

30.10 MOTOR LOAD CURVE

30.11 ZERO SPEED LOAD

30.12 BREAK POINT

Index Description: The break point frequency for the load curve. This parameter defines the point at which the motor load curve begins to decrease from the maximum value set by Parameter 30.10 MOTOR LOAD CURVE to the value of Parameter 30.11 ZERO SPEED LOAD. Used when the USER MODE is selected in Parameter 30.01 MOT THERM P MODE.
### Stall Protection

<table>
<thead>
<tr>
<th>30</th>
<th>Group name: FAULT FUNCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td><strong>STALL FUNCTION</strong></td>
</tr>
</tbody>
</table>

**Description:** This parameter defines the operation of the stall protection. The protection is activated if the following conditions are valid for a time longer than the period set by Parameter 30.15 STALL TIME LIM.

1. The motor torque is close to the internal momentary changing limit of the motor control program that prevents the motor and the inverter from overheating or the motor from pulling out.
2. The output frequency is below the level set by Parameter 30.14. STALL FREQ HI.
3. SPC TORQ MAX limit value must be higher than MAXIMUM TORQUE limit and SPC TORQ MIN must be lower than MINIMUM TORQUE.

**Operation in case of a motor stall condition.**

- 1 = **NO** no action
- 2 = **WARNING** A warning is produced.
- 3 = **FAULT** A fault is produced.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Unit</th>
<th>Type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td><strong>STALL FREQ HI</strong></td>
<td>Hz</td>
<td>R</td>
<td>0.5</td>
<td>50</td>
<td>20</td>
<td>100 == 1 Hz</td>
</tr>
</tbody>
</table>

**Description:** Frequency limit for the stall protection logic.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Unit</th>
<th>Type</th>
<th>Min</th>
<th>Max</th>
<th>Def</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td><strong>STALL TIME</strong></td>
<td>s</td>
<td>R</td>
<td>10</td>
<td>400</td>
<td>20</td>
<td>1 == 1 s</td>
</tr>
</tbody>
</table>
### Underload Protection

#### Parameter 30

**Group name:** FAULT FUNCTIONS

**Index:** UNDERLOAD FUNC

**Description:**

The absence of motor load may indicate a process malfunction. The protection is activated if:

1. The motor torque drops below the load curve selected by Parameter 30.18 UNDERLOAD CURVE.
2. The condition has lasted longer than the time set by Parameter 30.17 UNDERLOAD TIME.
3. Output frequency is higher than 10% of the nominal frequency of the motor.

The protection function assumes that the drive is equipped with a motor of the rated power.

**Operation in case of the underload fault.**

1 = NO  no action
2 = WARNING A warning is produced.
3 = FAULT A fault is produced.

**Parameter 17**

**Index:** UNDERLOAD TIME

**Index Description:** Time limit for underload logic.

**Unit:** s  **Type:** R  **Min:** 0 s  **Max:** 600 s  **Def:** 600 s  **Integer scaling:** 1 == 1

**Parameter 18**

**Index:** UNDERLOAD CURVE

**Index Description:** One of the 5 fixed underload curves can be selected for the underload protection

**Unit:**  **Type:** I  **Min:** 1  **Max:** 5  **Def:** 1  **Integer scaling:**

**Parameter 19**

**Index:** MOTOR PHASE LOSS

**Index Description:** Operation in case a motor phase is lost.

1 = FAULT Enabled.
0 = NO Disabled.

**Unit:**  **Type:** B  **Min:**  **Max:**  **Def:** NO  **Integer scaling:** 1 == 1
### Chapter 5 – Parameters

#### 30 Group name: FAULT FUNCTIONS

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Operation in case of an earth fault condition.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>EARTH FAULT</td>
<td>1 = FAULT A fault is produced. 0 = WARNING A warning is produced.</td>
</tr>
</tbody>
</table>

| unit: type: B | Min: 0 | Max: 1 | Def: FAULT | Integer scaling: 1 == 1 |

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Operation in case local control (control panel or DriveWindow) is lost.</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>PANEL LOSS</td>
<td>1 = FAULT A fault is produced. 0 = LAST SPEED A warning is produced.</td>
</tr>
</tbody>
</table>

| unit: type: B | Min: 0 | Max: 1 | Def: FAULT | Integer scaling: 1 == 1 |

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>This parameter activates the undervoltage controller. If the DC voltage level starts to decrease, the torque reference is reduced and the motor acts as a generator.</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>UNDERVOLTAGE CTL</td>
<td>1 = ON Enabled. 0 = OFF Disabled.</td>
</tr>
</tbody>
</table>

| unit: type: B | Min: 0 | Max: 1 | Def: OFF | Integer scaling: 1 == 1 |

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>This parameter activates the overvoltage controller. The overvoltage controller increases the torque if the DC-bus voltage exceeds the limit - typically when the motor is running as a generator and there is no regenerative incoming supply or braking chopper with resistors.</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>OVERVOLTAGE CTL</td>
<td>1 = ON Enabled. 0 = OFF Disabled. (This is the normal mode with regenerative supply sections.)</td>
</tr>
</tbody>
</table>

| unit: type: B | Min: 0 | Max: 1 | Def: ON | Integer scaling: 1 == 1 |

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Unwanted NINT board current measurement or communication faults can be masked in situations where the DC intermediate circuit voltage has been disconnected but the NAMC board has an external power supply and fault indication is not needed. A fault is produced only when the motor is started. See also Parameter 31.02 START INHIBIT ALM.</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>PPCC FAULT MASK</td>
<td>1 = YES Fault mask enabled.</td>
</tr>
</tbody>
</table>

| unit: type: B | Min: 0 | Max: 1 | Def: NO | Integer scaling: 1 == 1 |

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>The earth fault trip level is set through the PPCC link by means of this parameter (non parallel connected inverters R10i, R11i and R12i only). For the parallel connected inverters this function is the current unbalance protection of the inverter output (e.g. short circuit).</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>EARTH FAULT LEVEL</td>
<td>0 = Disabled. 1 = 1% unbalance in the sum current. 2 = 3% unbalance in the sum current. 3 = 8% unbalance in the sum current. 4 = 13% unbalance in the sum current. 5 = 18% unbalance in the sum current. 6 = 28% unbalance in the sum current. 7 = 39% unbalance in the sum current. 8 = 62% unbalance in the sum current.</td>
</tr>
</tbody>
</table>

| unit: type: R | Min: 0 | Max: 8 | Def: 5 | Integer scaling: 1 == 1 |

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Digital output control upon a communication fault on CH0, if controlled via ACW. Note that this parameter does not affect digital output DO1.</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>COMM LOSS RO</td>
<td>0 = ZERO Digital outputs are de-energised. 1 = LAST VALUE The states of the digital outputs before the communication fault are retained.</td>
</tr>
</tbody>
</table>

| unit: type: B | Min: | Max: | Def: ZERO | Integer scaling: 1 == 1 |
### Chapter 5 – Parameters

#### FAULT FUNCTIONS

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>Description:</th>
</tr>
</thead>
</table>
| 27    | AI<MIN FUNC | This parameter selects the action if the current signal on analogue inputs AI2 or AI3 (or NAIO input AI2) falls below 4 mA. This monitoring is valid if 4 mA is selected in Parameter 13.06 MINIMUM AI2 or 13.10 MINIMUM AI3..  
1 = FAULT  
2 = NO  
3 = LAST SPEED  
A fault is generated.  
(No action)  
A warning is generated. The drive continues running at the last speed before the warning. |
| unit: | type: I    | Min: 1  
Max: 3  
Def: 1  
Integer scaling: |

#### Motor Thermal Model User Mode Alarm and Fault Limits

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>THERM MOD ALM LIM</td>
<td>An alarm temperature limit for the thermal model protection of the motor. The thermal model of the motor is activated by Parameter 30.01 MOTOR THERM PMODE and calculated temperature is shown by the signal 1.18 MOTOR TEMP EST.</td>
</tr>
</tbody>
</table>
| unit: °C | type: I  
Min:  0 °C  
Max:  300 °C  
Def:  90 °C  
Integer scaling: |
| 29    | THERM MOD FLT LIM | A trip temperature limit for the thermal model protection of the motor. |
| unit: °C | type: I  
Min:  0 °C  
Max:  300 °C  
Def:  110 °C  
Integer scaling: |
| 30    | MOT NOM TEMP RISE | Motor nominal temperature rise when loading with motor nominal current. |
| unit: °C | type: R  
Min:  0 °C  
Max:  300 °C  
Def:  80 °C  
Integer scaling: 1 == 1 °C |
| 31    | AMBIENT TEMP | Typical motor ambient temperature. Used only with motor thermal protection model. |
| unit: °C | type: R  
Min: -40 °C  
Max:  100 °C  
Def:  30 °C  
Integer scaling: 1 == 1 °C |

#### Motor Temperature Feedback to the Motor Model

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>RS TEMP SCALE</td>
<td>Tuning coefficient for temperature dependence of stator resistance $R_s$ based on the measured temperature with PT100 sensors or internal motor thermal protection model. The measured total resistance includes motor cable and stator resistance. With pulse encoder feedback, 100% compensation can often be used. Undercompensation decreases the starting torque at high motor temperatures.</td>
</tr>
</tbody>
</table>
| unit: % | type: R    | Min: 0 %  
Max: 200%  
Def: 40 %  
Integer scaling: 1 == 1 % |
### Group 31 Fault Functions

**01**  
**Parameter: KLIXON MOT OVER T**  
**Description:** Action when the contact of digital input KLIXON opens. See Parameter **10.05 KLIXON**.  
- **0 = FAULT**  
- **1 = ALARM**  
**Unit:**  
- **Type:** B  
- **Min:** 0  
- **Max:** 1  
- **Def:** 0  
- **Integer scaling:** 1 == 1

**02**  
**Parameter: START INHIBIT ALM**  
**Description:** Logging of the Prevention of Unexpected Start-up alarm “START INHIBIT” (9.04 AW_1 bit 0) to the fault/alarm logger can be prevented using this parameter. This function has no effect on status or alarm words.  
- **0 = OFF**  
- **1 = ON**  
Logging disabled  
**Unit:**  
- **Type:** B  
- **Min:** 0  
- **Max:** 1  
- **Def:** 0  
- **Integer scaling:** 1 == 1

### Group 35 Motor Fan Control

**01**  
**Parameter: MOTOR FAN CTRL**  
**Description:** This parameter activates the motor fan diagnostics and the timer functions to signal ASW2 (8.06) bit 0.  
- **1 = OFF**  
- **2 = ALARM**  
- **3 = ALARM/FAULT**  
Motor fan control and diagnostics enabled. If the acknowledge signal is lost, an alarm “MOTOR FAN” is generated. If the acknowledge signal is still lost after 35.04 FAN ACK DELAY, a fault is indicated and drive is tripped.  
**Unit:**  
- **Type:** I  
- **Min:** 1  
- **Max:** 3  
- **Def:** 1  
**Integer scaling:**

**02**  
**Parameter: FAN ACK DELAY**  
**Description:** An acknowledge signal delay. Delay time count starts on the activation of FAN ON CMD.  
**Unit:**  
- **Type:** R  
- **Min:** 2 s  
- **Max:** 300 s  
- **Def:** 5 s  
- **Integer scaling:** 1 == 1 s

**03**  
**Parameter: FAN OFF DELAY**  
**Description:** A delay off function for the motor fan starter control. FAN ON CMD is controlled to state false when the time defined by this parameter has elapsed.  
**Unit:**  
- **Type:** R  
- **Min:** 0 min  
- **Max:** 100 min  
- **Def:** 20 min  
- **Integer scaling:** 1 == 1 min

**04**  
**Parameter: FAN ON DELAY**  
**Description:** A delay on function for the motor fan starter control, since the motor has been magnetised and FAN ON CMD is controlled to state true.  
**Unit:**  
- **Type:** R  
- **Min:** 0 s  
- **Max:** 100 s  
- **Def:** 0 s  
- **Integer scaling:** 1 == 1 s
### Group 36 Motor Cable Protection

**01 CABLE NOM CURRENT**

Description: The permitted continuous current for the motor cable, including possible limitation factors due to the environment conditions (ambient temperature, distances to other cables, etc.). See the cable manufacturer’s data book.

The new values become valid only on the next NAMC board power-on.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>CABLE NOM CURRENT</td>
</tr>
</tbody>
</table>

**02 CABLE TEMP CONST**

Description: Permitted loading time for the motor cable in seconds by load $\sqrt{2} \times$ CABLE NOM CURRENT. See the cable manufacturer’s data book.

The new values become valid only on the next NAMC board power-on.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>CABLE TEMP CONST</td>
</tr>
</tbody>
</table>

### Group 50 Speed Measurement

**01 SPEED SCALING**

Description: This parameter defines the speed reference (in rpm) that corresponds to the value of 20000 from the overriding system or I/O. This parameter has only scaling effect to speed actual signals in the scalar control mode.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>SPEED SCALING</td>
</tr>
</tbody>
</table>

**02 SPEED MEAS MODE**

Description: Selects the measurement type for the pulse encoder mode.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>SPEED MEAS MODE</td>
</tr>
</tbody>
</table>

#### Diagram for SPEED MEASUREMENT

- **filter**: SPEED_FB_SEL
- **filter**: SPEED_MEAS_MODE
- **filter**: SPEED_SCALING
- **filter**: MOTOR_SP_FILT
- **filter**: MOTOR_SPEED

ACS 600 Firmware Manual, System Application Program 6.x
### Chapter 5 – Parameters

#### SPEED MEASUREMENT

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>Description:</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>SPEED FB SEL</td>
<td>Source of the speed feedback to the speed controller.</td>
<td>03</td>
</tr>
<tr>
<td>04</td>
<td>ENCODER PULSE NR</td>
<td>Number of pulse encoder pulses per revolution.</td>
<td>04</td>
</tr>
<tr>
<td>05</td>
<td>ENCODER ALM/FLT</td>
<td>Determines if speed measurement error causes a warning or a fault.</td>
<td>05</td>
</tr>
<tr>
<td>06</td>
<td>SP ACT FILT TIME</td>
<td>The time constant of the first order actual speed filter.</td>
<td>06</td>
</tr>
<tr>
<td>07</td>
<td>POS COUNT MODE</td>
<td>The position counter is based on the pulse count from the pulse encoder.</td>
<td>07</td>
</tr>
<tr>
<td>08</td>
<td>POS COUNT INIT LO</td>
<td>Position counter initial low word value when the mode is PULSE EDGES.</td>
<td>08</td>
</tr>
<tr>
<td>09</td>
<td>POS COUNT INIT HI</td>
<td>Position counter initial high word value when the mode is PULSE EDGES.</td>
<td>09</td>
</tr>
<tr>
<td>10</td>
<td>ABOVE SPEED LIMIT</td>
<td>When the actual speed has reached the value of this parameter, 8.01 MAIN STATUS WORD bit 10 is set to 1.</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>ENCODER DELAY</td>
<td>Time of no encoder pulses received, and the drive being at the torque or current limit simultaneously, before an alarm or a fault is produced. Setting this parameter to 0 disables the function at the torque or current limit.</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>MOTOR SP FILT TIME</td>
<td>Filter time constant for monitoring signal 1.01 MOTOR SPEED FILT.</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
<th>03</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>Source of the speed feedback to the speed controller.</td>
<td>03</td>
</tr>
<tr>
<td>04</td>
<td>Number of pulse encoder pulses per revolution.</td>
<td>04</td>
</tr>
<tr>
<td>05</td>
<td>Determines if speed measurement error causes a warning or a fault.</td>
<td>05</td>
</tr>
<tr>
<td>06</td>
<td>The time constant of the first order actual speed filter.</td>
<td>06</td>
</tr>
<tr>
<td>07</td>
<td>The position counter is based on the pulse count from the pulse encoder.</td>
<td>07</td>
</tr>
<tr>
<td>08</td>
<td>Position counter initial low word value when the mode is PULSE EDGES.</td>
<td>08</td>
</tr>
<tr>
<td>09</td>
<td>Position counter initial high word value when the mode is PULSE EDGES.</td>
<td>09</td>
</tr>
<tr>
<td>10</td>
<td>When the actual speed has reached the value of this parameter, 8.01 MAIN STATUS WORD bit 10 is set to 1.</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>Time of no encoder pulses received, and the drive being at the torque or current limit simultaneously, before an alarm or a fault is produced. Setting this parameter to 0 disables the function at the torque or current limit.</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>Filter time constant for monitoring signal 1.01 MOTOR SPEED FILT.</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
<th>03</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>Source of the speed feedback to the speed controller.</td>
<td>03</td>
</tr>
<tr>
<td>04</td>
<td>Number of pulse encoder pulses per revolution.</td>
<td>04</td>
</tr>
<tr>
<td>05</td>
<td>Determines if speed measurement error causes a warning or a fault.</td>
<td>05</td>
</tr>
<tr>
<td>06</td>
<td>The time constant of the first order actual speed filter.</td>
<td>06</td>
</tr>
<tr>
<td>07</td>
<td>The position counter is based on the pulse count from the pulse encoder.</td>
<td>07</td>
</tr>
<tr>
<td>08</td>
<td>Position counter initial low word value when the mode is PULSE EDGES.</td>
<td>08</td>
</tr>
<tr>
<td>09</td>
<td>Position counter initial high word value when the mode is PULSE EDGES.</td>
<td>09</td>
</tr>
<tr>
<td>10</td>
<td>When the actual speed has reached the value of this parameter, 8.01 MAIN STATUS WORD bit 10 is set to 1.</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>Time of no encoder pulses received, and the drive being at the torque or current limit simultaneously, before an alarm or a fault is produced. Setting this parameter to 0 disables the function at the torque or current limit.</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>Filter time constant for monitoring signal 1.01 MOTOR SPEED FILT.</td>
<td>12</td>
</tr>
</tbody>
</table>
50

<table>
<thead>
<tr>
<th>Group name:</th>
<th>SPEED MEASUREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index:</td>
<td>13</td>
</tr>
</tbody>
</table>
| Description: | This parameter can be adjusted for the best possible performance at the low speeds when a pulse encoder is used and pulses are not received during the 1 ms measurement cycle. 

The definition of “low speeds” depends on the type of the encoder used. For example if encoder pulse number is 2048 and both edges of A and B channels are calculated, there are 8192 pulses per revolution. Then at least one pulse per millisecond is received at 7.3 rpm (1 pulse / ms ⇒ 1000 pulses/s ⇒ 1000/8192 rev/s = 7.3 rpm). Thus 4 ms between pulses corresponds to 1.8 rpm and 80 ms to 0.09 rpm.

See the following example with parameter settings:
50.13 = 250 ms, 50.14 = 4 ms, constant speed reference.

After receiving a pulse, measured speed is calculated and speed control P-part is set to a value related to speed error. When no new pulses are received within 1 ms, the measured speed and P-part (due the constant speed reference) are held. After the SPEED HOLD TIME P-part is forced to zero so that speed control will not be based on an obsolete speed measurement value. After ZERO DETECT DELAY, it is assumed that speed is zero, causing clearing of measured speed and allowing use of P-part.

After the next pulse, some measured speed is calculated again and P-part accordingly. P-part is cleared again after SPEED HOLD TIME. The measured speed is not set to zero anymore, because a new pulse comes before ZERO DETECT DELAY.

The time between pulses 3 and 4 is still longer than SPEED HOLD TIME and P-part is forced to zero.

The time between pulses 4 and 5 is already so short that neither P-part nor the measured speed is forced to zero.

With the configuration of figure 1 there is a long ZERO DETECT DELAY that gives accurate speed measurement. The short SPEED HOLD TIME keeps the speed control stable in many cases, because speed control output is not influenced by “old” speed measurement. On the other hand, if P-part is very large, forcing it to zero causes undesirable torque steps.

The tuning values depends on the clearances of mechanics. Therefore after increasing these parameter values, check that the torque actual value is still smooth.

unit: ms type: I Min: 1 ms Max: 2000 ms Def: 4 ms Integer scaling:
### Chapter 5 – Parameters

#### Group 50 SPEED MEASUREMENT

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>SPEED HOLD TIME</th>
</tr>
</thead>
</table>
| 14    | Description: | The time after the P-part of speed control is forced to zero, if the time has been elapsed and no new pulses have been received after the last sample. By increasing the value, it amplifies the effect of P-part at the low speeds due to the longer effect time of P-part. Oscillation can occur, if the time is too long. See description of Par. 50.13 ZERO DETECT DELAY above.  
**Note:** The value of SPEED HOLD TIME <= ZERO DETECT DELAY. |
| Unit: | ms | type: I | Min: | Max: 2000 ms | Def: 4 ms | Integer scaling: |

#### Group 51 Master Adapter (Field Bus Adapter)

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>MASTER ADAPTER</th>
</tr>
</thead>
</table>
| 01    | Description: | This group defines the communication parameters for a fieldbus adapter module. The parameter names are copied from the module when its connection to the drive is activated using Parameter 98.02 COMM MODULE. See the module manual.  
**Note:** Any changes in these parameters take effect only upon the next power-up of the adapter module. |
| unit: | type: R | Min: | Max: | Def: | Integer scaling: |
| 02...15 | FIELDBUS PAR2...15 (According to module type) | | | | |
| unit: | type: R | Min: | Max: | Def: | Integer scaling: |
### Group 70 DDCS Control

#### 70 Group name: **DDCS CONTROL**
Description: Parameter settings of the DDCS communication channels.

<table>
<thead>
<tr>
<th><strong>Index</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>01</strong></td>
<td><strong>CH0 NODE ADDR</strong></td>
</tr>
<tr>
<td>Index</td>
<td>Description: Node address for channel CH0. In an AC 80 DriveBus connection, the drives are addressed 1 to 12. The drive address is related to the value of the DRNR terminal of the ACSRX PC element. When using the APC2 system, the address must be 1. In an Optical ModuleBus connection, the CH0 NODE ADDR value is calculated from the value of the POSITION terminal in the DRIENG database element as follows: 1. Multiply the hundreds of the value of position by 16. 2. Add the tens and ones of the value of POSITION to the result. For example, if the POSITION terminal of the DRIENG database element has the value of 101, Parameter 70.01 must be set 16 x 1 + 1 = 17.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>unit:</strong></th>
<th><strong>type:</strong></th>
<th><strong>Min:</strong></th>
<th><strong>Max:</strong></th>
<th><strong>Def:</strong></th>
<th><strong>Integer scaling:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>0</td>
<td>125</td>
<td>1</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>

| **02**    | **CH0 LINK CONTROL** |
| Index     | Description: DDCS channel 0 intensity control for transmission LEDs. This parameter can be used in special cases to optimise the communication performance of the link. |

<table>
<thead>
<tr>
<th><strong>unit:</strong></th>
<th><strong>type:</strong></th>
<th><strong>Min:</strong></th>
<th><strong>Max:</strong></th>
<th><strong>Def:</strong></th>
<th><strong>Integer scaling:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>1</td>
<td>15</td>
<td>10</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>

| **03**    | **CH0 BAUD RATE** |
| Index     | Description: Channel CH0 communication speed. This must be set to 4 Mbits/s, when FCI or FBA communication modules are used. Otherwise, the overriding system automatically sets the communication speed. 0 = 8 Mbit/s 1 = 4 Mbit/s 2 = 2 Mbit/s 3 = 1 Mbit/s |

<table>
<thead>
<tr>
<th><strong>unit:</strong></th>
<th><strong>type:</strong></th>
<th><strong>Min:</strong></th>
<th><strong>Max:</strong></th>
<th><strong>Def:</strong></th>
<th><strong>Integer scaling:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mbit/s</td>
<td>I</td>
<td>1 Mbit/s</td>
<td>8 Mbit/s</td>
<td>4 Mbit/s</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>

| **04**    | **CH0 TIMEOUT** |
| Index     | Description: The delay time before a communication break fault is declared. The time count starts when the link fails update the message. Setting this parameter to 0 disables the function. |

<table>
<thead>
<tr>
<th><strong>unit:</strong></th>
<th><strong>type:</strong></th>
<th><strong>Min:</strong></th>
<th><strong>Max:</strong></th>
<th><strong>Def:</strong></th>
<th><strong>Integer scaling:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>ms</td>
<td>R</td>
<td>0 ms</td>
<td>60000 ms</td>
<td>100 ms</td>
<td>1 == 1 ms</td>
</tr>
</tbody>
</table>

| **05**    | **CH0 COM LOSS CTRL** |
| Index     | Description: This parameter defines the action after a communication fault on channel CH0. See also Parameter 30.26 COM LOSS RO. |

<table>
<thead>
<tr>
<th><strong>unit:</strong></th>
<th><strong>type:</strong></th>
<th><strong>Min:</strong></th>
<th><strong>Max:</strong></th>
<th><strong>Def:</strong></th>
<th><strong>Integer scaling:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

| **06**    | **CH1 LINK CONTROL** |
| Index     | Description: DDCS channel CH1 intensity control for transmission LEDs. This value is adjusted through the link including each device on the link. This parameter can be used in special cases to optimise the communication performance of the link. |

<table>
<thead>
<tr>
<th><strong>unit:</strong></th>
<th><strong>type:</strong></th>
<th><strong>Min:</strong></th>
<th><strong>Max:</strong></th>
<th><strong>Def:</strong></th>
<th><strong>Integer scaling:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>1</td>
<td>15</td>
<td>10</td>
<td>1 == 1</td>
</tr>
<tr>
<td>70</td>
<td>Group name:</td>
<td>07</td>
<td><strong>CH2 NODE ADDR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>-------------</td>
<td>----</td>
<td>------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index</td>
<td>Description:</td>
<td>Node address for channel CH2. This is used only in applications, with one or several point to point communications connections between the NAMC boards.</td>
<td>unit: type:</td>
<td>R</td>
<td>Min:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>08</th>
<th><strong>CH2 M/F MODE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>Description:</td>
</tr>
<tr>
<td>1</td>
<td>= <strong>NOT IN USE</strong></td>
</tr>
<tr>
<td>2</td>
<td>= <strong>MASTER</strong></td>
</tr>
<tr>
<td>3</td>
<td>= <strong>FOLLOWER</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>09</th>
<th><strong>MASTER SIGNAL 1</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>Description:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10</th>
<th><strong>MASTER SIGNAL 2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>Description:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>11</th>
<th><strong>MASTER SIGNAL 3</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>Description:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>12</th>
<th><strong>CH2 LINK CONTROL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>Description:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13</th>
<th><strong>CH2 TIMEOUT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>Description:</td>
</tr>
</tbody>
</table>

unit: type: | R | Min: | 0 ms | Max: | 60000 ms | Def: | 100 ms | Integer scaling: | 1 == 1 |
### 70 CH2 COM LOSS CTRL

**Description:**
This parameter defines the action upon a communication fault on CH2 of the NAMC board. Drive is tripped, fault M/F LINK FAULT activated and 9.01 FAULT WORD 1 bit 11 is set to 1.

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name: DDCS CONTROL</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>CH2 COM LOSS CTRL</td>
<td>This parameter defines the action upon a communication fault on CH2 of the NAMC board. Drive is tripped, fault M/F LINK FAULT activated and 9.01 FAULT WORD 1 bit 11 is set to 1. The warning M/F LINK ALARM is generated and 9.04 ALARM WORD 1 bit 11 is set to 1.</td>
</tr>
</tbody>
</table>

| unit: | type: I | Min: 1 | Max: 2 | Def: 1 | Integer scaling: |

### 15 CH3 NODE ADDR

**Description:**
Node address for channel CH3. This channel is normally used with the start-up and maintenance tools. If the CH3 channels of several drives have been connected in a ring or star (using a branching unit), each one must be given unique node address. The new node address becomes valid only on the next NAMC board power-on. The address range is 1…75 and 125…254. Addresses 75…124 are reserved for branching units.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>CH3 NODE ADDR</td>
</tr>
</tbody>
</table>

| unit: | type: R | Min: 1 | Max: 254 | Def: 15 | Integer scaling: 1 == 1 |

### 17 FOLL SPEED REF

**Description:**
This parameter defines the source for the speed reference in the Master/Follower mode.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>FOLL SPEED REF</td>
</tr>
</tbody>
</table>

| unit: | type: B | Min: | Max: | Def: FOLLOWER | Integer scaling: 1 == 1 |

### 19 CH0 HW CONNECTION

**Description:**
This parameter is used to enable or disable the regeneration of CH0 optotransmitter in DDCS mode (Par. 71.01 DRIVEBUS MODE = OFF). Regeneration means that the drive echoes all messages back. DDCS mode is typically used with APC2, AC70 and AC450 controllers.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>CH0 HW CONNECTION</td>
</tr>
</tbody>
</table>

| unit: | type: B | Min: 0 | Max: 1 | Def: 1 = STAR | Integer scaling: 1 == 1 |

Note: This parameter has no effect in DriveBus mode. Select RING, if the CH0 channels on the NAMC boards have been connected to ring.
### Group 71 DriveBus Communication

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
<th>Parameter settings of DriveBus communication on channel CH0. Available with sw ver. 5.2. Not available with NAMC-03/04 boards.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td><strong>CH0 DRIVEBUS MODE</strong></td>
<td>Communication mode selection for channel CH0. The Drivebus mode is used with the AC 80 controller. <strong>The new mode becomes valid only on the next NAMC board power-on.</strong>&lt;br&gt;&lt;br&gt;0 = NO DDCS mode&lt;br&gt;1 = YES DriveBus mode</td>
</tr>
<tr>
<td>unit:</td>
<td>type:</td>
<td>Min:</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0</td>
</tr>
</tbody>
</table>

### Group 90 Data Set Receive Addresses

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
<th>Addresses for Received Data from the Overriding System. The format is (x)x, where (x)x = Group, y = Index. Overriding System</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td><strong>D SET REC ADDR</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>D SET 10 VAL 1</strong></td>
<td>Data set 10 value 1 receive address (Interval: NAMC-03/-11:10 ms, NAMC-2x: 2 ms).</td>
</tr>
<tr>
<td>Unit:</td>
<td>type:</td>
<td>Min:</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>0</td>
</tr>
<tr>
<td>02</td>
<td><strong>D SET 10 VAL 2</strong></td>
<td>See 90.01 Interval: NAMC-03:10 ms, NAMC-2x: 2 ms</td>
</tr>
<tr>
<td>03</td>
<td><strong>D SET 10 VAL 3</strong></td>
<td>See 90.01 Interval: NAMC-03:10 ms, NAMC-2x: 2 ms</td>
</tr>
<tr>
<td>04</td>
<td><strong>D SET 12 VAL 1</strong></td>
<td>See 90.01 Interval: NAMC-03:10 ms, NAMC-2x: 4 ms</td>
</tr>
<tr>
<td>05</td>
<td><strong>D SET 12 VAL 2</strong></td>
<td>See 90.01 Interval: NAMC-03:10 ms, NAMC-2x: 4 ms</td>
</tr>
<tr>
<td>06</td>
<td><strong>D SET 12 VAL 3</strong></td>
<td>See 90.01 Interval: NAMC-03:10 ms, NAMC-2x: 4 ms</td>
</tr>
<tr>
<td>07</td>
<td><strong>D SET 14 VAL 1</strong></td>
<td>See 90.01 Interval: NAMC-03:100 ms, NAMC-2x: 10 ms</td>
</tr>
<tr>
<td>08</td>
<td><strong>D SET 14 VAL 2</strong></td>
<td>See 90.01 Interval: NAMC-03:100 ms, NAMC-2x: 10 ms</td>
</tr>
<tr>
<td>09</td>
<td><strong>D SET 14 VAL 3</strong></td>
<td>See 90.01 Interval: NAMC-03:100 ms, NAMC-2x: 10 ms</td>
</tr>
<tr>
<td>10</td>
<td><strong>D SET 16 VAL 1</strong></td>
<td>See 90.01 Interval: NAMC-03:100 ms, NAMC-2x: 10 ms</td>
</tr>
<tr>
<td>11</td>
<td><strong>D SET 16 VAL 2</strong></td>
<td>See 90.01 Interval: NAMC-03:100 ms, NAMC-2x: 10 ms</td>
</tr>
<tr>
<td>12</td>
<td><strong>D SET 18 VAL 1</strong></td>
<td>See 90.01 Interval: NAMC-03:100 ms, NAMC-2x: 100 ms</td>
</tr>
<tr>
<td>13</td>
<td><strong>D SET 18 VAL 2</strong></td>
<td>See 90.01 Interval: NAMC-03:100 ms, NAMC-2x: 100 ms</td>
</tr>
<tr>
<td>14</td>
<td><strong>D SET 18 VAL 3</strong></td>
<td>See 90.01 Interval: NAMC-03:100 ms, NAMC-2x: 100 ms</td>
</tr>
<tr>
<td>15</td>
<td><strong>D SET 20 VAL 1</strong></td>
<td>See 90.01 Interval: NAMC-03:500 ms, NAMC-2x: 100 ms</td>
</tr>
<tr>
<td>16</td>
<td><strong>D SET 20 VAL 2</strong></td>
<td>See 90.01 Interval: NAMC-03:500 ms, NAMC-2x: 100 ms</td>
</tr>
<tr>
<td>17</td>
<td><strong>D SET 20 VAL 3</strong></td>
<td>See 90.01 Interval: NAMC-03:500 ms, NAMC-2x: 100 ms</td>
</tr>
<tr>
<td>18</td>
<td><strong>D SET 20 VAL 4</strong></td>
<td>See 90.01 Interval: NAMC-03:500 ms, NAMC-2x: 100 ms</td>
</tr>
</tbody>
</table>
### Group 91 Data Set Receive Addresses

<table>
<thead>
<tr>
<th>Group name:</th>
<th>D SET REC ADDR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Addresses for Received Data from the Overriding System. The format is (x)xyy, where (x)x = Group, yy = Index.</td>
</tr>
<tr>
<td>91</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>D SET 22 VAL 1</td>
</tr>
<tr>
<td>02</td>
<td>D SET 22 VAL 2</td>
</tr>
<tr>
<td>03</td>
<td>D SET 22 VAL 3</td>
</tr>
<tr>
<td>04</td>
<td>D SET 24 VAL 1</td>
</tr>
<tr>
<td>05</td>
<td>D SET 24 VAL 2</td>
</tr>
<tr>
<td>06</td>
<td>D SET 24 VAL 3</td>
</tr>
</tbody>
</table>

### Group 92 Data Set Transmit Addresses

<table>
<thead>
<tr>
<th>Group name:</th>
<th>D SET TR ADDR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Signal addresses for the transmitted data to the overriding system. The format is (x)xyy, where (x)x = Group, yy = Index.</td>
</tr>
<tr>
<td>92</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>D SET 11 VAL 1</td>
</tr>
<tr>
<td>02</td>
<td>D SET 11 VAL 2</td>
</tr>
<tr>
<td>03</td>
<td>D SET 11 VAL 3</td>
</tr>
<tr>
<td>04</td>
<td>D SET 13 VAL 1</td>
</tr>
<tr>
<td>05</td>
<td>D SET 13 VAL 2</td>
</tr>
<tr>
<td>06</td>
<td>D SET 13 VAL 3</td>
</tr>
<tr>
<td>07</td>
<td>D SET 15 VAL 1</td>
</tr>
<tr>
<td>08</td>
<td>D SET 15 VAL 2</td>
</tr>
<tr>
<td>09</td>
<td>D SET 15 VAL 3</td>
</tr>
<tr>
<td>10</td>
<td>D SET 17 VAL 1</td>
</tr>
<tr>
<td>11</td>
<td>D SET 17 VAL 2</td>
</tr>
<tr>
<td>12</td>
<td>D SET 17 VAL 3</td>
</tr>
<tr>
<td>13</td>
<td>D SET 19 VAL 1</td>
</tr>
<tr>
<td>14</td>
<td>D SET 19 VAL 2</td>
</tr>
<tr>
<td>15</td>
<td>D SET 19 VAL 3</td>
</tr>
<tr>
<td>16</td>
<td>D SET 21 VAL 1</td>
</tr>
<tr>
<td>17</td>
<td>D SET 21 VAL 2</td>
</tr>
<tr>
<td>18</td>
<td>D SET 21 VAL 3</td>
</tr>
</tbody>
</table>
### Group 93 Data Set Transmit Addresses

**Description:** Signal addresses for the transmitted data to the overriding system. The format is \((x)xyy\), where \((x)x = \text{Group}, yy = \text{Index}.

<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
<th>Value</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>D SET 23 VAL 1</td>
<td>See 92.01</td>
<td>NAMC-03:500 ms, NAMC-2x: 100 ms</td>
</tr>
<tr>
<td>02</td>
<td>D SET 23 VAL 2</td>
<td>See 92.01</td>
<td>NAMC-03:500 ms, NAMC-2x: 100 ms</td>
</tr>
<tr>
<td>03</td>
<td>D SET 23 VAL 3</td>
<td>See 92.01</td>
<td>NAMC-03:500 ms, NAMC-2x: 100 ms</td>
</tr>
<tr>
<td>04</td>
<td>D SET 25 VAL 1</td>
<td>See 92.01</td>
<td>NAMC-03:500 ms, NAMC-2x: 100 ms</td>
</tr>
<tr>
<td>05</td>
<td>D SET 25 VAL 2</td>
<td>See 92.01</td>
<td>NAMC-03:500 ms, NAMC-2x: 100 ms</td>
</tr>
<tr>
<td>06</td>
<td>D SET 25 VAL 3</td>
<td>See 92.01</td>
<td>NAMC-03:500 ms, NAMC-2x: 100 ms</td>
</tr>
</tbody>
</table>

### Group 97 Drive

**Description:**
- **DEVICE NAME**
  - The name of the drive section can be typed here by the Drive Window PC tool. This name is shown in the System Configuration display of Drive Window. The maximum number of characters is 32.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Value</th>
<th>Unit</th>
<th>Type</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>DEVICE NAME</td>
<td></td>
<td></td>
<td>String</td>
<td>0 char</td>
<td>32 char</td>
<td>0</td>
<td>no</td>
</tr>
</tbody>
</table>

### Group 98 Option Modules

**Description:**
- **OPTION MODULES**
  - The optional NTAC, NAIO and NDIO modules are connected in a ring (together with the NIOC board) on NAMC channel CH1. Each of these modules is given an address using the DIP switches on them. (The NIOC always has the address 1.) Fieldbus adapter modules are connected to channel CH0.

**ENCODER MODULE**
- NTAC-02 pulse encoder module or NIOB-01 pulse encoder interface selection. The module is connected in series with the NIOC board on channel CH1. The module is given the address 16 by setting the DIP switches as shown below.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = YES</td>
<td>Pulse encoder module or NIOB-01 pulse encoder interface activated.</td>
</tr>
<tr>
<td>0 = NO</td>
<td>Pulse encoder module or NIOB-01 pulse encoder interface not activated.</td>
</tr>
</tbody>
</table>

**Note:** See the parameter settings in Group 50 and Par. 98.07

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Value</th>
<th>Unit</th>
<th>Type</th>
<th>Min:</th>
<th>Max:</th>
<th>Def:</th>
<th>Integer scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>ENCODER MODULE</td>
<td></td>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td>NO</td>
<td>1 == 1</td>
</tr>
</tbody>
</table>
### OPTION MODULES

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Group name:</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>COMM MODULE</td>
<td>98</td>
<td>This parameter defines the control mode and place in the REMOTE mode.</td>
</tr>
</tbody>
</table>
|       |             | OPTIONS     | 1 = NO 
2 = FBA DSET 1 
3 = FBA DSET10 |
|       |             | OPTIONS     | The drive is controlled using the I/O. See settings in the parameter group 10. |
| 03    | D/I/O EXT MODULE 1 | 03          | The drive is controlled through the communication link (channel CH0) using data sets 1 and 2. This is a typical setting for use with a fieldbus adapter module. |
|       |             | OPTIONS     | The drive is controlled through the communication link (channel CH0) using data sets 10 to 33 (for example APC2, AC 70, AC 80: also NPBA-02, NCSA-01). |

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Group name:</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>OPTIONS</td>
<td>The drive is controlled through the communication link (channel CH0) using data sets 10 to 33 (for example APC2, AC 70, AC 80: also NPBA-02, NCSA-01).</td>
</tr>
</tbody>
</table>

**Note:** DI1 HW filtering must be enabled, if AC voltage is connected to DI1.
### OPTION MODULES

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>1 = NO</th>
<th>2 = REPLACE</th>
<th>3 = EXTEND</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>NDIO I/O extension module 2 can be used to replace or extend the I/O. Module is connected to channel CH1 on the NAMC board. The module is given the address 3 by setting the DIP switches as shown below.</td>
<td>No NDIO module 2 used.</td>
<td>NDIO replaces NIOC DI3, DI4, and DO3. EXT2.DO1 is activated.</td>
<td>Activates extended I/O: EXT2.DO1, EXT2.DO2, and EXT2.DO3</td>
</tr>
<tr>
<td>05</td>
<td>NDIO I/O extension module 3 can be used to replace or extend the I/O. Module is connected to channel CH1 on the NAMC board. The module is given the address 4 by setting the DIP switches as shown below.</td>
<td>No NDIO module 3 used.</td>
<td>NDIO replaces NIOC DI5, DI6. EXT3.DO1 and EXT3.DO2 are activated.</td>
<td>Activates extended I/O: EXT3.DO1, EXT3.DO2, and EXT3.DO3</td>
</tr>
</tbody>
</table>

Note: DI1 HW filtering must be enabled, if AC voltage is connected to DI1.
## Chapter 5 – Parameters

### 06 A/O EXT MODULE 1

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This parameter configures the inputs and outputs of an NAIO analogue I/O extension module. The NAIO module is given the address 5 by setting the DIP switches as shown below. The available input type settings are also illustrated.</td>
</tr>
<tr>
<td></td>
<td><strong>Group name:</strong> OPTION MODULES</td>
</tr>
<tr>
<td></td>
<td><strong>06</strong> A/O EXT MODULE 1</td>
</tr>
<tr>
<td>1 = <strong>NO</strong></td>
<td>No extension AIO board used.</td>
</tr>
<tr>
<td>2 = <strong>UNIPOLAR AI</strong></td>
<td>An NAIO module replaces NIOC-01 AI1 and AI2, and extends sw outputs AO3 and AO4.</td>
</tr>
<tr>
<td>3 = <strong>BIPOLAR AI</strong></td>
<td>An NAIO module replaces NIOC-01 AI1 and AI2, and extends sw outputs AO3 and AO4.</td>
</tr>
<tr>
<td>4 = <strong>UNIPOL. TEMP</strong></td>
<td>Motor temperature measurement (PT100 or PTC) using NAIO module, NIOB-01 board or NBIO-21 unit.</td>
</tr>
<tr>
<td>5 = <strong>BIPOLAR TEMP</strong></td>
<td>Motor temperature measurement (PT100 or PTC) using NAIO module, NIOB-01 board or NBIO-21 unit.</td>
</tr>
</tbody>
</table>

---

### 07 BASIC I/O BOARD

<table>
<thead>
<tr>
<th>Index</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The selection and supervision of the basic I/O-board is done by means of this parameter. The address of the NIOC-01 is always 1 and with NBIO-21 or NIOB-01 address is 10 (A) set by switch S1 in the NBIO-21 I/O unit.</td>
</tr>
<tr>
<td></td>
<td><strong>Group name:</strong> OPTION MODULES</td>
</tr>
<tr>
<td></td>
<td><strong>07</strong> BASIC I/O BOARD</td>
</tr>
<tr>
<td>1 = <strong>NIOC-01</strong></td>
<td></td>
</tr>
<tr>
<td>2 = <strong>NBIO-21</strong></td>
<td></td>
</tr>
<tr>
<td>3 = <strong>NO</strong></td>
<td></td>
</tr>
<tr>
<td>4 = <strong>NIOB-01</strong></td>
<td></td>
</tr>
</tbody>
</table>

---

Old NAIO-01 and NAIO-02 modules are compatible types. See switch settings above.
Chapter 5 – Parameters

Analogue I/O in v. 6.x of System Application with NIOB-01 / NBIO-21

98.06 = NO
98.07 = NBIO21/NIOB
30.03 = NOT IN USE

98.06 = UNIPOLAR AI or BIPOLAR AI
98.07 = NBIO21/NIOB
30.03 = NOT IN USE
30.06 = NOT IN USE

98.06 = NO
98.07 = NBIO21/NIOB
30.03 = 1xPT100, 2xPT100, 3xPT100 or 1...3 PTC

Connect PT100/PTC to AI2 and Speed Ref to AI1, if I/O Speed Ref is also required.

98.06 = NO
98.07 = NBIO21/NIOB
30.03 & 30.06 = 1xPT100, 2xPT100, 3xPT100 or 1...3 PTC

30.03 = NOT IN USE

98.06 = UNIPOLAR TEMP or BIPOLAR TEMP
30.03 = 1xPT100, 2xPT100, 3xPT100 or 1...3 PTC
30.06 = 1xPT100, 2xPT100, 3xPT100 or 1...3 PTC

Figure 5 - 3 Analogue I/O Configuration Examples of NBIO-21 or NIOB Basic I/O Board with Corresponding Parameter Selections.
## Analogue I/O in the version 6.x of System Application with NIOC-01

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>98.06 = NO</td>
<td>NIOC-01</td>
</tr>
<tr>
<td>98.07 = NIOC-01</td>
<td>30.03 = NOT IN USE</td>
</tr>
</tbody>
</table>

**Figure 5 - 4 Analogue I/O Configuration Examples of NIOC-01 Basic I/O Board with Corresponding Parameter Selections.**
Note: The drive will not start if the Start-up Data Parameters have not been changed from the factory settings, or the nominal current of the motor is too small compared to the nominal current of the inverter.

**WARNING!** Running the motor and the driven equipment with incorrect start-up data can result in improper operation, reduction in control accuracy and damage to equipment.

If several motors are connected to the ACS 600 drive, some additional instructions must be considered when setting the Start-up Data Parameters. Please contact your local ABB representative for more information.

Note: Changing any of the motor parameters in Group 99, causes the cancellation of all existing Motor ID Run results!

### Group 99 Start Up Data

<table>
<thead>
<tr>
<th>99</th>
<th>Group name:</th>
<th>Description: Parameters for setting up the motor information.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Index</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>Index</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Index</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>Index</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>Index</td>
<td></td>
</tr>
</tbody>
</table>

#### Parameter 99-01 LANGUAGE
- **Index**: 01
- **Type**: L
- **Description**: If English (Am) is selected, the unit of power used is HP instead of kW.
- **Values**:
  - 0 = ENGLISH
  - 1 = ENGLISH AM
  - 2 = DEUTSCH available since System SW version 5.2
  - 3 = ITALIANO not available
  - 4 = ESPAÑOL not available
  - 5 = PORTUGUÉS not available
  - 6 = NEDERLANDS not available
  - 7 = FRANÇAIS not available
  - 8 = DANSK not available
  - 9 = SUOMI not available
  - 10 = SVENSKA not available

#### Parameter 99-02 MOTOR NOM VOLTAGE
- **Index**: 02
- **Type**: R
- **Description**: Nominal voltage from the motor rating plate. It is not possible to start the ACS 600 without setting this parameter.
- **Note**: It is not allowed to connect a motor with nominal voltage less than 1/2 * UN or more than 2 * UN of the ACS 600.
- **Values**:
  - Min: 207 V
  - Max: 830 V
  - Def: 0 V
- **Integer scaling**: 1 == 1V

#### Parameter 99-03 MOTOR NOM CURRENT
- **Index**: 03
- **Type**: R
- **Description**: Rated motor current. If several motors are connected to the inverter, enter the total current of the motors.
- **Values**:
  - Min: 0 A
  - Max: 18000 A
  - Def: 0 A
- **Integer scaling**: 10 == 1A

#### Parameter 99-04 MOTOR NOM FREQ
- **Index**: 04
- **Type**: R
- **Description**: Nominal frequency from the motor rating plate.
- **Note**: If the nominal frequency of the motor is higher than 50 Hz, speed limits in DTC mode or frequency limits in scalar control mode must be set before an ID Run command. See Parameter Group 20 DTC mode or Group 29 (SCALAR control mode).
- **Values**:
  - Min: 8 Hz
  - Max: 300 Hz
  - Def: 50 Hz
- **Integer scaling**: 100 == 1 Hz

#### Parameter 99-05 MOTOR NOM SPEED
- **Index**: 05
- **Type**: R
- **Description**: Nominal speed from the motor rating plate.
- **Values**:
  - Min: 1 rpm
  - Max: 18000 rpm
  - Def: 1 rpm
- **Integer scaling**: 1 == 1 rpm
### Chapter 5 – Parameters

<table>
<thead>
<tr>
<th>06</th>
<th>MOTOR NOM POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Index</strong></td>
<td>Description: Nominal power from the motor rating plate. If several motors are connected to the inverter, enter the total power of the motors. Set also parameter 99.12 MOTOR NOM COS Fll.</td>
</tr>
<tr>
<td><strong>Unit:</strong> kW</td>
<td><strong>Type:</strong> R</td>
</tr>
<tr>
<td><strong>Min:</strong> 0 kW</td>
<td><strong>Max:</strong> 9000 kW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>07</th>
<th>MOTOR ID RUN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Index</strong></td>
<td>Description: This parameter is used to initiate the Motor Identification Run. During the run, the drive will identify the characteristics of the motor for optimum motor control. The ID Run takes about one minute. The ID Run cannot be performed if scalar control is selected (Parameter 99.08 is set to SCALAR).</td>
</tr>
<tr>
<td><strong>Note:</strong> The ID Run (Standard or Reduced) should be selected if:</td>
<td></td>
</tr>
<tr>
<td>• operation point is near zero speed</td>
<td></td>
</tr>
<tr>
<td>• operation at torques above the motor nominal torque within a wide speed range and without a pulse encoder is required.</td>
<td></td>
</tr>
<tr>
<td><strong>Note:</strong> Check the rotation direction of the motor by first start before starting the Motor ID Run. During the run the motor will rotate in the forward direction.</td>
<td></td>
</tr>
<tr>
<td><strong>Warning:</strong> The motor will run at up to approximately 50%... 80% of nominal speed during the Motor ID Run. BE SURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE MOTOR ID RUN.</td>
<td></td>
</tr>
<tr>
<td><strong>1 = NO</strong></td>
<td>The Motor ID Run is not performed. If an ID Run has not been done yet, or any of the motor parameters have been changed, the motor will start the mode FIRST START after the start command has been given. The DC-magnetising phase lasts much longer than the normal start because the stator resistance and other electrical losses are first identified and stored into the FPROM memory.</td>
</tr>
<tr>
<td><strong>2 = STANDARD</strong></td>
<td>Performing the Standard Motor ID Run guarantees the best possible control accuracy. The motor must be decoupled from the driven equipment before performing the Standard ID Run.</td>
</tr>
<tr>
<td><strong>3 = REDUCED</strong></td>
<td>Only to be selected if the motor cannot be decoupled from the driven equipment. The Reduced Motor ID Run should be selected in applications where mechanical losses are higher than 20% (i.e. the load cannot be disconnected) or where flux reduction is not allowed (i.e. there are auxiliary devices connected in parallel with the motor) while the motor is running.</td>
</tr>
<tr>
<td><strong>Unit:</strong></td>
<td><strong>Type:</strong> I</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>08</th>
<th>MOTOR CTRL MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Index</strong></td>
<td>Description: Motor control mode selection.</td>
</tr>
<tr>
<td><strong>1 = SCALAR</strong></td>
<td>Scalar control mode.</td>
</tr>
<tr>
<td><strong>0 = DTC-</strong></td>
<td>Direct Torque Control mode.</td>
</tr>
<tr>
<td>If several motors are connected to the inverter, there are certain restrictions on the usage of DTC. Please contact your local ABB representative for more information.</td>
<td></td>
</tr>
<tr>
<td><strong>Unit:</strong></td>
<td><strong>Type:</strong> B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>09</th>
<th>APPLIC RESTORE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Index</strong></td>
<td>Description: Restores either USER MACRO 1, USER MACRO 2 or FACTORY parameter values depending on the selection in Parameter 99.11 APPLICATION MACRO except parameter group 99.</td>
</tr>
<tr>
<td><strong>1 = YES</strong></td>
<td>Values are restored.</td>
</tr>
<tr>
<td><strong>0 = NO</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Unit:</strong></td>
<td><strong>Type:</strong> B</td>
</tr>
</tbody>
</table>
### Chapter 5 – Parameters

<table>
<thead>
<tr>
<th>Index</th>
<th>Group name:</th>
<th>START UP-DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>99</td>
<td>DRIVE ID NUMBER</td>
<td>Description: This parameter can be used by the overriding system to check the correct connections of the optical cables to the drive type. This parameter requires support from the overriding system.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>unit: type: I</td>
</tr>
<tr>
<td>10</td>
<td>APPLICATION MACRO</td>
<td>Description: This parameter selects the application macro to be used. In addition to the default settings (FACTORY), two user-definable parameter sets (USER) are available.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: The Back-Up function in DriveWindow only saves the active User Macro if called: thus both User Macros must be backed up separately.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In addition to the FACTORY setting there is a selection for saving the current settings as a User Macro (USER 1 SAVE or USER 2 SAVE), and recalling these settings (USER 1 LOAD or USER 2 LOAD).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If User Macro 1 or 2 is in use, the parameter values are restored to the last saved values. In addition, the last saved results of the motor identification are restored. Exception: Settings of Parameters 16.05 and 99.11 remain unchanged.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factory parameters (default values) are recalled and stored to the FPROM memory.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parameter set 1 (User Macro 1) is loaded to the RAM memory.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parameter set 1 (User Macro 1) is saved to the FPROM memory.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parameter set 2 (User Macro 2) is loaded to the RAM memory.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parameter set 2 (User Macro 2) is saved to the FPROM memory.</td>
</tr>
<tr>
<td>11</td>
<td>APPLICATION MACRO 1</td>
<td>Description: This parameter selects the application macro to be used. In addition to the default settings (FACTORY), two user-definable parameter sets (USER) are available.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: The Back-Up function in DriveWindow only saves the active User Macro if called: thus both User Macros must be backed up separately.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In addition to the FACTORY setting there is a selection for saving the current settings as a User Macro (USER 1 SAVE or USER 2 SAVE), and recalling these settings (USER 1 LOAD or USER 2 LOAD).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If User Macro 1 or 2 is in use, the parameter values are restored to the last saved values. In addition, the last saved results of the motor identification are restored. Exception: Settings of Parameters 16.05 and 99.11 remain unchanged.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factory parameters (default values) are recalled and stored to the FPROM memory.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parameter set 1 (User Macro 1) is loaded to the RAM memory.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parameter set 1 (User Macro 1) is saved to the FPROM memory.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parameter set 2 (User Macro 2) is loaded to the RAM memory.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parameter set 2 (User Macro 2) is saved to the FPROM memory.</td>
</tr>
<tr>
<td>12</td>
<td>MOTOR NOM COS FII</td>
<td>Description: Cos $\phi$ from the motor rating plate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>unit: type: R</td>
</tr>
<tr>
<td>13</td>
<td>POWER IS GIVEN</td>
<td>Description: The first start/ID run can be performed by using either power or Cos $\phi$ of the motor. Cos $\phi$ is recommended. Use power selection if Cos $\phi$ is unknown.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>unit: type: B</td>
</tr>
</tbody>
</table>
Chapter 6 - Overview of the CDP 312 Control Panel

Overview

This chapter describes the programming principles of the ACS 600 using the CDP 312 Control Panel.

The user can change the configuration of the ACS 600 to meet the needs of the requirements by programming. The ACS 600 is programmable through a set of parameters. This chapter describes the operation of the CDP312 Control Panel and how to use the panel with the ACS 600 to modify the parameters, to measure the actual values and to control the drive(s).

Panel Link

The CDP312 Control Panel is connected to the drive through a Modbus-protocol communication bus. Modbus is the common bus protocol for ABB Drives products. The communication speed is 9600 bit/s. 31 drives and one panel can be connected on this bus. Each station must have a unique ID number.

Figure 6 - 1 CDP 312 Control Panel
Chapter 6 – Overview of the CDP 312 Control Panel

**Display**

The LCD type display has 4 lines of 20 characters.

The language selection is made at Start-up by Parameter 99.01 LANGUAGE. Depending on the customers selection, a set of four languages is loaded into the memory of the ACS 600 at the factory.

**Keys**

The Control Panel keys are flat, labelled, push-button keys that allow you to monitor drive functions, select drive parameters, and change settings.

```
1 L
0.0 rpm 0
MOTOR TO 0.00 %
LED PANE 0 %
MOTOR SP 0.0 rpm
MOTOR TO 0.00 %
99 START-UP DATA
01 LANGUAGE
ENGLISH
```

**Actual Signal Display Mode**

- ACT
- ENTER
- DISPLAY/GROUP SELECTION
- ROW/PARAMETER SELECTION
- ENTER SELECTION MODE
- ACCEPT NEW PARAMETER

**Parameter Mode**

- PAR
- ENTER
- GROUP SELECTION
- FAST VALUE CHANGE
- PARAMETER SELECTION
- SLOW VALUE CHANGE
- ENTER SELECTION MODE
- ACCEPT NEW PARAMETER

**Function Mode**

- FUNC
- ENTER
- ROW SELECTION
- FUNCTION START

**Drive Selection Mode**

- DRIVE
- ENTER
- DRIVE/ID SELECTION
- ENTER CHANGE MODE
- ACCEPT NEW VALUE

*) Name of the downloaded FCB (Function Chart Builder) application.

**Figure 6 - 2 Control Panel Display Indications and Functions of the Control Panel Keys**

```
Status Row
Actual Signals
Names and Values

\[ \begin{array}{c}
1 L \\
0.0 rpm \\
0 % \\
MOTOR SP \\
0.0 rpm \\
MOTOR TO \\
0.00 % \\
99 START-UP DATA \\
01 LANGUAGE \\
ENGLISH \\
\end{array} \]
```

**Figure 6 - 3 Operational Commands of the Control Panel Keys**

```
LOC
REM
Keypad / External Control

AMAM15D3 980605
Application sw name + version. *)

AMAM15D3 980605
ID-NUMBER 1

\[ \begin{array}{c}
HCN 634 980605.3 \\
DRYER SECTION 1 \\
AMAM15D3 980605 \\
ID-NUMBER 1 \\
\end{array} \]
```

*) Name of the downloaded FCB (Function Chart Builder) application.
The following is a description of the operation of the CDP 312 Control Panel.

**Keypad Modes**

The CDP 312 Control Panel has four different keypad modes: Actual Signal Display Mode, Parameter Mode, Function Mode, and Drive Selection Mode. In addition, there is a special Identification Display, which is displayed after connecting the panel to the link. The Identification Display and the keypad modes are described briefly below.

When the panel is connected for the first time, or the power is applied to the drive, the Identification Display appears, showing the panel type and the number of drives connected to the Panel Link.

**Note:** The panel can be connected to the drive while power is applied to the drive.

![ID NUMBER 1]

After two seconds, the display will clear, and the Actual Signals of the drive will appear.

**Actual Signal Display Mode**

This mode includes two displays, the Actual Signal Display and the Fault History Display. The Actual Signal Display is displayed first when the Actual Signal Display mode is entered. If the drive is in a fault condition, the Fault Display will be shown first.

The panel will automatically return to Actual Signal Display Mode from other modes if no keys are pressed within one minute (exceptions: Status Display in Drive Selection Mode and Fault Display Mode).

In the Actual Signal Display Mode you can monitor three Actual Signals at a time.

The Fault History includes information on the 16 most recent faults that have occurred in your ACS 600. The name of the fault and the total power-on time are displayed. If the APC2 overriding system has been connected to the drive (DDCS channel 0), this time can be seen in the date format instead of power-on time.
The following table shows the events that are stored in the Fault History. For each event it is described what information is included.

<table>
<thead>
<tr>
<th>Event</th>
<th>Information</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>A fault is detected by ACS 600</td>
<td>Sequential number of the event. Name of the fault and a “+” sign in front of the name. Total power on time or date and time updated by overriding system.</td>
<td>1 L ( \Rightarrow ) 0.0 rpm 0 2 LAST FAULT +OVERCURRENT 12 H 49 MIN 10 S</td>
</tr>
<tr>
<td>A fault is reset by user.</td>
<td>Sequential number of the event. -RESET FAULT text. Total power on time or date and time updated by the overriding system.</td>
<td>1 L ( \Rightarrow ) 0.0 rpm 0 1 LAST FAULT -RESET FAULT 12 H 50 MIN 10 S</td>
</tr>
<tr>
<td>A warning is activated by ACS 600</td>
<td>Sequential number of the event. Name of the warning and a “+” sign in front of the name. Total power on time or date and time updated by the overriding system.</td>
<td>1 L ( \Rightarrow ) 0.0 rpm 0 1 LAST WARNING +EMESTOP 12 H 50 MIN 10 S</td>
</tr>
<tr>
<td>A warning is deactivated by ACS 600</td>
<td>Sequential number of the event. Name of the warning and a “-” sign in front of the name. Total power on time or date and time updated by the overriding system.</td>
<td>1 L ( \Rightarrow ) 0.0 rpm 0 1 LAST WARNING -EMESTOP 12 H 50 MIN 35 S</td>
</tr>
</tbody>
</table>

When a fault or warning occurs in the drive, the message will be displayed immediately, except in the Drive Selection Mode. From the fault display, it is possible to change to other displays without resetting the fault. If no keys are pressed the fault or warning text is displayed as long as the fault exists.
Chapter 6 – Overview of the CDP 312 Control Panel

**Table 6 - 1 How to Display the Full Name of the three Actual Signals**

<table>
<thead>
<tr>
<th>Step</th>
<th>Function</th>
<th>Press key</th>
<th>Display after key is pressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To display the full name of the three actual signals</td>
<td>Hold ACT</td>
<td>1 L 0.0 rpm 0 LED PANEL OUTP MOTOR SPEED FILT MOTOR TORQUE FILT</td>
</tr>
<tr>
<td>2.</td>
<td>To return to the Actual Signal Display Mode.</td>
<td>Release ACT</td>
<td>1 L 0.0 rpm 0 LED PANNE 0 % MOTOR SP 0.0 rpm MOTOR TO 0.00 %</td>
</tr>
</tbody>
</table>

**Table 6 - 2 How to Select Actual Signals to the Display**

<table>
<thead>
<tr>
<th>Step</th>
<th>Function</th>
<th>Press key</th>
<th>Display after key is pressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To enter the Actual Signal Display Mode</td>
<td>ACT</td>
<td>1 L 0.0 rpm 0 LED PANNE 0 % MOTOR SP 0.0 rpm MOTOR TO 0.00 %</td>
</tr>
<tr>
<td>2.</td>
<td>To select the desired row.</td>
<td></td>
<td>1 L 0.0 rpm 0 LED PANNE 0 % MOTOR SP 0.0 rpm MOTOR TO 0.00 %</td>
</tr>
<tr>
<td>3.</td>
<td>To enter the Actual Signal Selection Mode.</td>
<td>ENTER</td>
<td>1 L 0.0 rpm 0 1 ACTUAL SIGNALS 01 MOTOR SPEED FILT 0.0 rpm</td>
</tr>
<tr>
<td>4.</td>
<td>To select a different group.</td>
<td></td>
<td>1 L 0.0 rpm 0 2 ACTUAL SIGNALS 01 SPEED REF 2 0 rpm</td>
</tr>
<tr>
<td>5.</td>
<td>To select a index.</td>
<td></td>
<td>1 L 0.0 rpm 0 2 ACTUAL SIGNALS 02 SPEED REF 3 0 rpm</td>
</tr>
<tr>
<td>6.</td>
<td>To accept the selection and to return to the Actual Signal Display Mode.</td>
<td>ENTER</td>
<td>1 L 0.0 rpm 0 LED PANNE 0 % SPEED REF 0.0 rpm MOTOR TO 0.00 %</td>
</tr>
</tbody>
</table>
## Table 6 - 3 How to Display a Fault and Reset the Fault History

<table>
<thead>
<tr>
<th>Step</th>
<th>Function</th>
<th>Press key</th>
<th>Display after key is pressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To enter the Actual Signal Display Mode</td>
<td><strong>ACT</strong></td>
<td><img src="display1.png" alt="Display" /></td>
</tr>
<tr>
<td>2.</td>
<td>To enter the Fault History Display. The time of occurrence can be seen either as total power-on time or in the date format if an overriding system (e.g. APC2) has been connected to control the drive.</td>
<td><img src="display2.png" alt="Display" /></td>
<td><img src="display3.png" alt="Display" /></td>
</tr>
<tr>
<td>3.</td>
<td>To clear all the faults from the Fault History Buffer. A view of cleared fault logger.</td>
<td><strong>RESET</strong></td>
<td><img src="display4.png" alt="Display" /></td>
</tr>
<tr>
<td>4.</td>
<td>To return to the Actual Signal Display Mode.</td>
<td><img src="display5.png" alt="Display" /></td>
<td><img src="display6.png" alt="Display" /></td>
</tr>
</tbody>
</table>

## Table 6 - 4 How to Display and Reset an Active Fault

<table>
<thead>
<tr>
<th>Step</th>
<th>Function</th>
<th>Press key</th>
<th>Display after key is pressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To enter the Actual Signal Display Mode.</td>
<td><strong>ACT</strong></td>
<td><img src="display7.png" alt="Display" /></td>
</tr>
<tr>
<td>2.</td>
<td>To reset the fault. The Reset button functions also in the REMOTE mode.</td>
<td><strong>RESET</strong></td>
<td><img src="display8.png" alt="Display" /></td>
</tr>
</tbody>
</table>

---

Chapter 6 – Overview of the CDP 312 Control Panel

ACS 600 Firmware Manual, System Application Program 6.x
Parameter Mode

The Parameter Mode is used for making changes to the ACS 600 parameters. When this mode is entered for the first time after power up, the display will show the first parameter of the first group. The next time, the Parameter Mode is entered, the previously selected parameter is shown.

**Note:** If you try to write to a write-protected parameter, the following warning will be displayed.

```
***WARNING***
WRITE ACCESS DENIED
PARAMETER SETTING
NOT POSSIBLE
```
### Table 6 - 5 How to Select a Parameter and Change the Value

<table>
<thead>
<tr>
<th>Step</th>
<th>Function</th>
<th>Press key</th>
<th>Display after key is pressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To enter the Parameter Mode.</td>
<td><strong>PAR</strong></td>
<td>1 L 0.0 rpm 0 13 ANALOGUE INPUTS 01 AI1 HIGH VALUE 10000</td>
</tr>
</tbody>
</table>
| 2.   | To select another parameter group.  
While holding the arrow down, only the group name and number are displayed.  
When the key is released, name, number and value of the first parameter in the group are displayed. |  | 1 L 0.0 rpm 0 14 DIGITAL OUTPUTS |
|      |          |           | 1 L 0.0 rpm 0 14 DIGITAL OUTPUTS 01 DO1 CONTROL OFF |
| 3.   | To select an index number.  
While holding the arrow down, only the parameter name and number are displayed.  
When the key is released the value of the parameter is also displayed. |  | 1 L 0.0 rpm 0 14 DIGITAL OUTPUTS 01 DO1 GROUP+INDEX |
|      |          |           | 1 L 0.0 rpm 0 14 DIGITAL OUTPUTS 02 DO1 GROUP+INDEX 801 |
| 4.   | To enter the parameter value. | **ENTER** | 1 L 0.0 rpm 0 14 DIGITAL OUTPUTS 02 DO1 GROUP+INDEX [801] |
| 5.   | To change the parameter value. (slow change)  
(fast change) |  | 1 L 0.0 rpm 0 14 DIGITAL OUTPUTS 02 DO1 GROUP+INDEX [901] |
| 6a.  | To send a new value to the drive. | **ENTER** | 1 L 0.0 rpm 0 14 DIGITAL OUTPUTS 02 DO1 GROUP+INDEX 901 |
| 6b.  | To cancel the new setting and keep the original value.  
The selected Keypad Mode is entered. | **ACT** **PAR** **FUNC** **DRIVE** | 1 L 0.0 rpm 0 14 DIGITAL OUTPUTS 02 DO1 GROUP+INDEX 801 |
The Function Mode is used to select special functions. These functions include Parameter Upload, Parameter Download and setting the contrast of the CDP 312 Panel Display.

Parameter Upload will copy existing parameters from Groups 10 to 98 from the drive to the panel. The upload function can be performed while the drive is running. Only the STOP command can be given during the uploading process.

Parameter Download will copy existing parameter Groups 10 to 97 stored in the panel to the drive.

Note: Parameters in Groups 98 and 99 concerning options, language and motor data are not copied.

If downloading is attempted before uploading, the following warning will be displayed:

```
**WARNING**
NOT POSSIBLE
NOT UPLOADED
DOWNLOADING
```

The parameters can be uploaded and downloaded only if the DTC software version and application software version (see Signals 4.02 DTC SW VERSION and 4.03 APPL SW VERSION) of the destination drive are the same as the software versions of the source drive. Otherwise the following warning will be displayed:

```
**WARNING**
DRIVE INCOMPATIBLE
DOWNLOADING
NOT POSSIBLE
```

The drive must be stopped during the downloading process. If the drive is running and downloading is selected, the following warning is displayed:

```
**WARNING**
DRIVE IS RUNNING
DOWNLOADING
NOT POSSIBLE
```
### Table 6 - 6 How to Select and Perform a Function

<table>
<thead>
<tr>
<th>Step</th>
<th>Function</th>
<th>Press key</th>
<th>Display after key is pressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To enter the Function Mode</td>
<td><strong>FUNC</strong></td>
<td>1 L → 0.0 rpm 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>UPLOAD &lt;= &lt;=</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOWNLOAD =&gt; =&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CONTRAST 0</td>
</tr>
<tr>
<td>2.</td>
<td>To select a function.</td>
<td><strong>&lt;&gt;</strong></td>
<td>1 L → 0.0 rpm 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>UPLOAD &lt;= &lt;=</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOWNLOAD =&gt; =&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CONTRAST 0</td>
</tr>
<tr>
<td>3.</td>
<td>To activate the selected function.</td>
<td><strong>ENTER</strong></td>
<td>1 L → 0.0 rpm 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>UPLOAD &lt;= &lt;=</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOWNLOAD =&gt; =&gt;</td>
</tr>
<tr>
<td>4.</td>
<td>Loading completed.</td>
<td></td>
<td>1 L → 0.0 rpm 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LED Pane 0 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MOTOR SP 0.0 rpm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MOTOR TO 0.00 %</td>
</tr>
</tbody>
</table>

### Table 6 - 7 How to Set the Contrast of the Panel Display.

<table>
<thead>
<tr>
<th>Step</th>
<th>Function</th>
<th>Press key</th>
<th>Display after key is pressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To enter the Function Mode</td>
<td><strong>FUNC</strong></td>
<td>1 L → 0.0 rpm 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>UPLOAD &lt;= &lt;=</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOWNLOAD =&gt; =&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CONTRAST 0</td>
</tr>
<tr>
<td>2.</td>
<td>To select a function.</td>
<td><strong>&lt;&gt;</strong></td>
<td>1 L → 0.0 rpm 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>UPLOAD &lt;= &lt;=</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOWNLOAD =&gt; =&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CONTRAST 0</td>
</tr>
<tr>
<td>3.</td>
<td>To enter the contrast setting function.</td>
<td><strong>ENTER</strong></td>
<td>1 L → 0.0 rpm 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CONTRAST [0]</td>
</tr>
<tr>
<td>4.</td>
<td>To set the contrast.</td>
<td><strong>&lt;&gt;</strong></td>
<td>1 L → 0.0 rpm 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CONTRAST [7]</td>
</tr>
<tr>
<td>5a.</td>
<td>To accept the selected value.</td>
<td><strong>ENTER</strong></td>
<td>1 L → 0.0 rpm 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>UPLOAD &lt;= &lt;=</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOWNLOAD =&gt; =&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CONTRAST 7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>UPLOAD &lt;= &lt;=</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOWNLOAD =&gt; =&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CONTRAST 0</td>
</tr>
</tbody>
</table>
You can copy parameters in Groups 10...97 from one drive to another by using the Parameter Upload and Parameter Download functions in the Function Mode. Typically this kind of function can be used if the processes and the motor types are same. This procedure is permitted only if the DTC SW and APPL SW versions are the same on both units. Follow the procedure below:

1. Select the correct options (Group 98) and language (Group 99) for each drive.
2. Set the rating plate values for the motors (Group 99) and perform the identification run for each motor if required.
3. Set the parameters in Groups 10 to 97 as preferred in one ACS 600 drive.
4. Upload the parameters from the ACS 600 to the panel (see Table 6-6).
5. Disconnect the panel and reconnect it to the next ACS 600 unit.
6. Download the parameters from the panel to the ACS 600 unit. (see Table 6-6).
7. Repeat steps 5 and 6 for the rest of the units.

**Note:** Parameters in Groups 98 and 99 concerning options, language and motor data are not copied.

If the Control Panel Display is not clear enough, set the contrast according to the procedure explained in Table 6-7.

In normal use, the features available in the Drive Selection Mode are not needed; these features are reserved for applications where several drives are connected to one Modbus Link.

Modbus Link is the communication link connecting the Control Panel and the ACS 600. Each on-line station must have an individual identification number (ID).

**Caution:** The default ID number setting of the ACS 600 must not be changed unless it is to be connected to the Modbus Link with other drives on-line.
## Table 6 - 8 How to Select a Drive

<table>
<thead>
<tr>
<th>Step</th>
<th>Function</th>
<th>Press key</th>
<th>Display after key is pressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To enter the Drive Selection Mode.</td>
<td><strong>DRIVE</strong></td>
<td>ACN 634 0005.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DRIVE NAME</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AMAM1050 980612</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ID NUMBER 1</td>
</tr>
<tr>
<td>2.</td>
<td>To select the drive.</td>
<td><strong>&lt;</strong></td>
<td>ACN 634 0005.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DRIVE NAME</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AMAM1050 980612</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ID NUMBER 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACN 634 0005.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DRIVE NAME</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AMAM1050 980612</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ID NUMBER 2</td>
</tr>
<tr>
<td></td>
<td>The drive connected to the panel is selected with the arrow buttons.</td>
<td></td>
<td>1 7 2 9 3 4 5 8 6 7 F 8 9 10</td>
</tr>
<tr>
<td></td>
<td>Selected ID number is shown on the bottom row in the display.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Status Display of all devices connected to the Panel Link is shown</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>after the last individual station. If all stations do not fit on the</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>display at once, press <strong>&lt;</strong> to view the rest of them.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>To connect to the last displayed drive and to enter another mode, press</td>
<td><strong>ACT</strong></td>
<td>1 L 7 0.0 RPM 0</td>
</tr>
<tr>
<td></td>
<td>one of the Mode keys.</td>
<td><strong>PAR</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The selected Keypad Mode is entered.</td>
<td><strong>FUNC</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LED PANE 0 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MOTOR SP 0.0 RPM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MOTOR TO 0.00 %</td>
</tr>
</tbody>
</table>
### Table 6 - 9 How to Change ID Number of the Drive

<table>
<thead>
<tr>
<th>Step</th>
<th>Function</th>
<th>Press key</th>
<th>Display after key is pressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To enter the Drive Selection Mode</td>
<td><img src="image" alt="DRIVE" /></td>
<td><img src="image" alt="ACN 634 0005_3 DRIVE NAME AMAM1050 980612 ID NUMBER 1" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>To select the next view. The ID number of the station is changed by first pressing ENTER (the brackets round the ID number appear) and then adjusting the value with the arrow buttons. The new value is accepted with ENTER. The power of the ACS 600 must be switched off to validate its new ID number setting (the new value is not displayed until the power is switched off and on). The Status Display of all devices connected to the Panel Link is shown after the last individual station. If all stations do not fit on the display at once, press <img src="image" alt="UP" /> to view the rest of them.</td>
<td><img src="image" alt="UP" /></td>
<td><img src="image" alt="ACN 634 0005_3 DRIVE NAME AMAM1050 980612 ID NUMBER 1" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>To connect to the last displayed drive and to enter another mode, press one of the Mode keys. The selected Keypad Mode is entered.</td>
<td><img src="image" alt="ACT PAR FUNC" /></td>
<td><img src="image" alt="I L 0.0 rpm 0 LED PANE 0 % MOTOR SP 0.0 rpm MOTOR TO 0.00 %" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Operational commands control the operation of the ACS 600. They include starting and stopping the drive, changing the direction of rotation and adjusting the reference. The reference value is used for controlling motor speed (Local Reference 1), motor torque (Local Reference 2) or frequency in scalar control (Local Reference 3).

Operational commands can be given from the CDP 312 Control Panel always when the status row is displayed and the control location is the panel. This is indicated by L (Local Control) on the display. See the following figure.

Remote Control (control from the overriding system or I/O is indicated by an empty field).

Operational commands cannot be given from this panel when in Remote Control. Only monitoring actual signals, setting parameters, uploading and changing ID numbers is possible.

The control is changed between Local and External control locations by pressing the LOC / REM key. Only one of the Local Control devices (CDP 312 or DriveWindow) can be used as the local control location at a time.

Direction of actual rotation is indicated by an arrow.

Start, Stop, Direction and Reference

Start, Stop and Direction commands are given from the panel by pressing the keys.
### Table 6 - 10 How to Set the Reference

<table>
<thead>
<tr>
<th>Step</th>
<th>Function</th>
<th>Press key</th>
<th>Display after key is pressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To display enter a Keypad Mode displaying the status row.</td>
<td>ACT PAR FUNC</td>
<td><img src="image" alt="Display" /></td>
</tr>
<tr>
<td>2.</td>
<td>To enter the Reference Setting Mode</td>
<td>REF</td>
<td><img src="image" alt="Display" /></td>
</tr>
<tr>
<td>3.</td>
<td>To change the reference. (slow change)</td>
<td></td>
<td><img src="image" alt="Display" /></td>
</tr>
<tr>
<td></td>
<td>(fast change)</td>
<td></td>
<td><img src="image" alt="Display" /></td>
</tr>
<tr>
<td>4.</td>
<td>To escape the Reference Setting Mode. The selected Keypad Mode is entered.</td>
<td>ACT PAR FUNC DRIVE</td>
<td><img src="image" alt="Display" /></td>
</tr>
</tbody>
</table>
Chapter 7 – Fault Tracing

Overview

This chapter describes the protections and fault tracing of ACS 600 drive.

Protections

I/O- Monitoring

If the Application and Motor Control Board (NAMC) cannot communicate with the I/O Control Board (NIOC), or with an I/O Extension Module connected to the I/O Extension Link, the following alarms are given:

- DIO ALARM bit 7 in ALARM WORD_1 (9.04)
- AIO ALARM bit 8 in ALARM WORD_1 (9.04)
- EXT DIO ALM bit 9 in ALARM WORD_1 (9.04)
- EXT AIO ALM bit 10 in ALARM WORD_1 (9.04)

Communication Monitoring

Messages received from the overriding system are monitored in the NAMC diagnostics program. The monitoring function is activated by parameter 70.4 CH0 TIME OUT. This parameter defines the delay before the communication fault is indicated. By entering a value of zero, this function is disabled. The action in case of communication fault is defined in the parameter CH0 COM LOSS CTRL (70.05). On a communication fault, bit 12 (fault “CH0 COM LOS”) in FAULT WORD 2 (9.02), is set to 1.

Note: If updating interval to the data set 10 is slower than 2 s, an alarm and fault is activated.

Inverter Overtemperature Fault

The ACS 600 drive supervises the inverter power plate module temperature. If it exceeds 115 °C, a warning “ACS 600 TEMP” is given and AW_1 (9.04) bit 4 is set to 1.

If the power plate module temperature exceeds 125°C, a fault “ACS 600 TEMP” is given and FW_1 (09.01) bit 3 is set to 1.

Ambient Temperature

The ACS 600 measures the ambient temperature on the surface of the NIOC board. The drive will not start if the temperature is below -5°C or above 73 to 82°C (depending on converter type). Also a fault “CABIN TEMP F” is given and FW_2 (9.02) bit 7 is set to1.

Overcurrent

The Overcurrent trip limit is 3.5 * I_{nom} (nominal motor current for heavy duty use). There are several sources of the overcurrent trip:

- Software trip (time level 100 µs, level = 97 % of measurement scale)
- Hardware level trip (97 % of measurement scale for 35 µs)
- Hardware derivative trip (12.5 % of measurement scale for 75 µs)
Chapter 7 – Fault Tracing

- Hardware level trip in parallel connected units by PBU logic (94 % of measurement scale for 75 μs)

A fault “OVERCURRENT” is given and FW_1 (09.01) bit 1 is set to 1.

The current measurement is calibrated automatically during the start procedure.

**DC Overvoltage**

The DC Overvoltage trip limit is $1.3 \times 1.35 \times U_{\text{max}}$, where $U_{\text{max}}$ is the maximum value of the mains voltage range.

<table>
<thead>
<tr>
<th>Nominal Voltage of Inverter Unit</th>
<th>$U_{\text{max}}$(AC)</th>
<th>$U_{\text{dc}}$ Overvoltage Trip Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 V</td>
<td>415 V</td>
<td>730 V</td>
</tr>
<tr>
<td>500 V</td>
<td>500 V</td>
<td>880 V</td>
</tr>
<tr>
<td>690 V</td>
<td>690 V</td>
<td>1210 V</td>
</tr>
</tbody>
</table>

A fault “DC OVERVOLT” is given and FW_1 (09.01) bit 2 is set to 1.

**Figure 7 - 1 DC Voltage Control and Tripping Limits**

**DC Undervoltage**

The DC Undervoltage trip limit is $0.60 \times 1.35 \times U_{\text{min}}$, where $U_{\text{min}}$ is the minimum value of the mains voltage range.

<table>
<thead>
<tr>
<th>Nominal Voltage of Inverter Unit</th>
<th>$U_{\text{min}}$(AC)</th>
<th>$U_{\text{dc}}$ Undervoltage Trip Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 V</td>
<td>380 V</td>
<td>307 V</td>
</tr>
<tr>
<td>500 V</td>
<td>380 V</td>
<td>307 V</td>
</tr>
<tr>
<td>690 V</td>
<td>525 V</td>
<td>425 V</td>
</tr>
</tbody>
</table>

A fault “DC UNDERSWOLT” is given and FW_2 (09.02) bit 2 is set to 1.
The Local Control Lost function defines the operation of the ACS 600 drive when, while in local control mode, the communication between the local control device (control panel or DriveWindow) and the ACS 600 stops.

**RUN ENABLE Interlocking Function**

Digital input DI2 state "0" activates the RUN ENABLE function, used for external RUN interlocking and for internal charging logic, when the optional load switch is used at the input DC circuit of the inverter unit. When the state of DI2 switches to 0, the drive stops by coasting, a fault “RUN DISABLD” is given and FW_2 (9.02) bit 4 and ASW (08.02) bit 4 are set to 1.

**START INHIBITION Interlocking Function**

START INHIBIT DI function is used to control and monitor the prevention of unexpected start-up function. Inverter IGBT pulses are first blocked directly by this digital input, when the safety relay -A40 or -K14 contact opens in the prevention of Unexpected start-up circuit. Selected digital input effects as an AND interlocking for the bit 3 (RUN) of Main Control Word. Status of both signals “START INHIBIT DI” digital input and “START INHIBIT” ASW (8.02) bit 8 from the PPCC link must follow each other within 3 seconds. If contact of “START INHIBIT DI” opens but still the status of “START INHIBIT” indicates different status, a fault “START INH HW” is given and bit 9.06 FW_3 (9.06) bit 1 is set. This diagnostics indicates incorrect HW and faulty NGPS board power supply. If there is no Prevention of Unexpected start-up circuit in use, selection NO must be selected.

**Short Circuit**

There are separate protection circuits for supervising the motor cable and the inverter short circuits. If a short circuit occurs, the drive will not start and a fault “SHORT CIRC” is given and FW_1 (09.01) bit 0 is set to “1”.

**Intermediate DC Link Current Ripple Fault**

Input phase loss protection circuits supervise the status of the mains in the supply section by detecting the intermediate current ripple. If an input phase is lost, the intermediate circuit current ripple increases. If the ripple exceeds 13% the drive is stopped and a fault “SUPPLY PHASE” is given. FW_2 (09.02) bit 0 is set to 1.

**Overspeed Fault**

If the ACS 600 drive output frequency exceeds the preset level (eg. in the case of overshooting in speed control), the drive is stopped and a fault “OVER FREQ” is given. FW_1 (09.01) bit 9 is set to 1. The trip level frequency margin is adjustable by Parameter FREQ TRIP MARGIN (20.11).
This section describes how to track the cause of earth fault in ACS 600 MultiDrive R2i-R12i, 2xR11i/R12i and 4xR11i/R12i modules.

Earth fault notification of inverters does not always indicate actual earth fault. Failure can sometimes be in IGBTs or NGDRs.

Earth fault notification

Are mains grounded? yes no

Measure: Earth leakage on motor or cabling?

yes no

Fault fixed?

yes no

R8-4xR12:

Check that currents I_1 and I_2 = 0A when U is on

yes no

Fault fixed?

yes no

Set Earth fault limit = 4

yes no

Change: Damaged motor, switchgear or cabling

yes no

R2-R7:

1. NINT-XX
2. Earth fault current transducer

yes no

Change: NGDR-XX damaged.

Breakthrough fault

yes no

Change: 1. NGDR-XX of the adjacent Power Plate(s)

yes no

Contact ABB Helsinki.

Set limit = 6

no yes

Change: Cabling to less capacitive one

yes no

Contact ABB Helsinki.

Set limit = 5

no yes

Is the fibre between NINT and NPBU damaged?

yes no

Contact ABB Helsinki.

Is the hottest INU (See Chart 1). Which is the hottest Phase / Power Plate?

Change: 1. NGDR of the hottest Power Plate

yes no

Are the inverters connected parallel?

yes no

Are the Power Plate temperatures within 5 °C?

yes no

Check the LEDs of the hottest INU

OK

Figure 7-2 This Flowchart can be used to Trace the Cause of Earth Fault and to Find Faulty Parts.
Indicator LEDs in the NINT Board

Following figure describes how to find the hottest phase or power plate by checking the LEDs of NINT-XX and NXPP-0X boards. This applies only to parallel connected phase modules and power plates of R8i – R12i modules.

![LED Indicator Diagram](image)

**Figure 7 - 3 LED Indicators of NINT Boards.**

**Interpretation of the LEDs**

- **All LEDs are unlit on NINT-XX or NXPP-0X board:**
  - No DC-voltage connected.
  - Possibly burned fuse on the NPOW-62 board.
  - Connection between NRED-61 and NPOW-62 is faulty.
  - Connection between NPOW-62 (X32) and NINT-XX (X42) is faulty.

- **Only one LED is lit on NINT-XX or NXPP-0X board:** That phase or power plate is hotter than the other ones.

- **One LED is brighter than other ones on NINT-XX or NXPP-0X board:** That phase or power plate is hotter than the other ones.

- **All LEDs are lit on NINT-XX or NXPP-0X board:** That phase or power plate is hotter than the other ones.

- **R8i – R9i modules:** The three LEDs of NINT-XX tell the hottest phase and also the hottest power plate, because on each phase there is only one power plate.
**R10i – R11i modules:** The upper three LEDs of NINT-XX board show, which phase is the hottest. The lower two LEDs of NINT-XX indicate the hottest power plate on V-phase and the two LEDs of NXPP-0X indicate the hottest power plate on U-phase (left NXPP-0X) and W-phase (right NXPP-0X). Two power plates are connected parallel in each phase module.

**R12i module:** The upper three LEDs of NINT-XX board show, which phase is the hottest. The lower three LEDs of NINT-XX tell the hottest power plate on V-phase and the three LEDs of NXPP-0X tell the hottest power plate on U-phase (left NXPP-0X) and W-phase (right NXPP-0X). Three parallel connected power plates are placed in each phase module.

The causes of overheated power plate are usually faulty NGDR-XX boards, damaged power plates or badly installed power plates (greasing or quality of the surface).

The colors of the three LEDs and the matching phases or power plates are:

- U-phase / power plate 1: Green (left)
- V-phase / power plate 2: Yellow (middle)
- W-phase / power plate 3: Red (right)

For two power plates per phase (R10i – R11i):
- Power plate T1: Yellow (left)
- Power plate T2: Green (right)

**Speed Measurement Fault**

Speed Measurement Fault is activated, if

- no pulses are received within the time of Parameter (50.11) **ENCODER DELAY** and the drive is simultaneously at the current or torque limit.
- measured and estimated speed differ 20 % from nominal speed of motor.
- there is no communication between the pulse encoder module and NAMC board.
- there is observed big change in the pulse frequency of the pulse encoder during 1 ms.

The Fault/Alarm function is activated by Parameter (50.05) **ENCODER ALM/FLT**. In case of a fault, **FW_2 (09.02)** bit 5 is set to 1 and a fault “**ENCODER FLT**” is given.
In case of an alarm, AW_1 (9.04) bit 5 is set to 1 and an alarm “ENCODER ERR” is given. If an alarm function has been selected and the speed measurement error is detected based on derivation term the drive automatically turns to use estimated speed. Drive uses estimated speed as long as the difference between estimated and measured speed is bigger than 1%. The difference is checked every five seconds. When the difference is smaller than 1% drive turns back to use measured speed. The status of the used actual speed can be seen from the ASW (802) bit 12.

Overswitching Frequency Fault

If the inner control loop exceeds the maximum switching frequency, a fault “OVER SWFREQ” is given and FW_2 (9.02) bit 9 is set to 1.

System Fault

If the program on the NAMC board has failed and causes an interruption, FW_1 (09.01) bit 7 (SYSTEM_FAULT) is set to 1.

Short Time Overloading

The inverter section of the ACS 600 MultiDrive incorporates an IGBT-transistor power stage. Duty Cycles A and B are presented for each inverter type in the ACS 600 MultiDrive catalogue (code 3BFE 63981915). See also the environmental limits.

\[
\begin{align*}
I_{\text{AC,NOMINAL}} &= \text{nominal current (continuous)} \\
I_{\text{AC,4/5 min}} &= I_2 \text{ base current for Duty Cycle A} \\
I_{\text{AC,1/5 min}} &= I_2 \text{ max current for Duty Cycle A (150\% of the base current } I_{\text{AC,4/5 min}}) \\
I_{\text{AC,50/60 s}} &= I_2 \text{ base current for Duty Cycle B} \\
I_{\text{AC,10/60 s}} &= I_2 \text{ max current for Duty Cycle B (200\% of the base current } I_{\text{AC,50/60 s}}) 
\end{align*}
\]

If the overload cycle is longer than described for Duty Cycle A or B, the inverter section is protected against the overload with a temperature measurement sensor and a software algorithm.

Overloading between \(I_{\text{AC,Nominal}}\) and \(I_{\text{AC,1/5 min}}\)

If the load current is continuously between \(I_{\text{AC,Nominal}}\) and \(I_{\text{AC,1/5 min}}\), the temperature of the IGBT power plate(s) and the heat sink will increase further. The overloading time is limited by means of the temperature sensor.
Chapter 7 – Fault Tracing

If the measured temperature exceeds 115 °C, a warning “ACS 600 TEMP” is given and Alarm Word 1 (AW1) bit 4 is set to 1.

If the power plate module temperature exceeds 125 °C, a fault “ACS 600 TEMP” is given and Fault Word 1 (FW1) bit 3 is set 1. The inverter pulses are blocked and the drive stops by coasting (zero torque).

The maximum current is limited by parameter 20.04 MAXIMUM CURRENT. If the actual current exceeds the $I_{AC,1/5\text{ min}}$ level, a software algorithm is also activated. The load cycle between $I_{AC,1/5\text{ min}}$ and the maximum current is time-limited as a function of current by means of a software integrator and thus the areas of the A1, A2 and A3 are equal.

$$A1 = 10 \text{s} \times (I_{AC,10/60s}-I_{AC,1/5\text{ min}}).$$

**Figure 7 - 4 Overloading Range between $I_{AC,\text{Nominal}}$ and $I_{AC,1/5\text{ min}}$ in ACA 610 2340-3**

Overloading between the $I_{AC,1/5\text{ min}}$ and Maximum Current

Forced Cooling Cycle

Short time Overload Cycle

A1 = A2 = A3

Overloading is limited by the inverter software

**Figure 7 - 5 Overloading example when the Load Current is > $I_{AC,1/5\text{ min}}$**

ACA 610 2340-3 Duty Cycle B examples
At the beginning of a forced cooling cycle, **AW_2 (9.05)** bit 2 is set to 1 and an alarm "**INV OVERLOAD**" is given.

**Motor Protections**

**Motor Thermal Protection Functions**

The motor can be protected against overheating by:
- activating the DTC motor thermal model or User Mode.
- measuring motor temperature by PT 100 or PTC sensors (1 or 2 separate measurement channels).
- by detecting the state of a thermal switch (KLIXON) inside the motor by the digital input DI6. See Parameter Group 10, selection KLIXON. If the contact opens, fault "**KLIXON**" is activated and **FW_1 (09.01)** bit 5 is set to 1.

The motor thermal model can be used parallel with other temperature protections (PTC, PT100, KLIXON).

![Motor Insulation Classes According to IEC 85](image)

**Figure 7 - 6 Motor Insulation Classes According to IEC 85**

The ACS 600 drive calculates the temperature of the motor based on the following assumptions:

1. The motor ambient temperature is 30 °C.
2. Motor temperature is calculated using either the user-adjustable or automatically calculated Motor Thermal Time and Motor Load Curve. The load curve should be adjusted in case the ambient temperature is higher than 30 °C.

The thermal model provides protection equivalent to standard class 10, 20, or 30 overload relays by setting the Motor Thermal Time to 350, 700, or 1050 seconds respectively and parameter **30.29 THERM MOD FLT L** to value 110 °C.
There are two levels of temperature monitoring:

- alarm “MOTOR TEMP” is activated when the alarm temperature limit defined by Parameter 30.28 THERM MOD ALM L is reached and AW_1 (09.04) bit 3 is set to 1.

- fault “MOTOR TEMP” is activated when the trip temperature limit defined by Parameter 30.29 THERM MOD FLT L is reached, FW_1 (09.01) bit 6 is set to 1.

Motor temperature can be measured by using the analogue inputs and outputs of the drive. The System Application program supports two measurement channels: AI1 and AI2 for motor 1 and motor 2 temperature measurements.

**WARNING!** According to IEC 664, the connection of the thermistor to the analogue I/O (NIOC-01 or NAIO) or to digital input DI6 of the NIOC-01 requires double or reinforced insulation between motor live parts and the thermistor. Reinforced insulation entails a clearance and creepage of 8 mm (400/500 VAC equipment). If the thermistor assembly does not fulfill the requirement, the other I/O terminals of ACS 600 must be protected against contact, or a thermistor relay must be used to isolate the thermistor from the digital input.

**Figure 7 - 7 Thermistor Connection example using Analogue I/O.**

Motor overtemperature can be detected by connecting 1…3 PTC thermistors, 1…3 PT100 elements or silicon temperature sensor KTY84-1xx (1000Ω at 100 °C). The purpose of the analogue output is to supply a constant current to the temperature element, the analogue input measures the voltage across the element. The application program sets the correct constant current according to the sensor type selection. Alarm and trip limits are defined by Parameters 30.04 and 30.05 for the motor 1 and 30.07 and 30.08 for the motor 2.

- alarm “MOTOR TEMP M” is activated when the alarm temperature limit is reached. AW_1 (09.04) bit 2 is set to 1.

- fault “MOTOR TEMP M” is activated when the trip temperature limit is reached and the FW_1 (09.01) bit 5 is set to 1.
• **Note:** The thermistor can also be connected to digital input DI6 on the NIOC board according to the following figure. If direct thermistor connection is used, digital input DI6 goes to 0 false when resistance rises higher than 4 kΩ. As a result, the drive is tripped, fault “KLIXON” is activated and appended to the fault logger, and FW_1 (09.01) bit 5 is set to 1.

Alternative 1

Alternative 2: At the motor end, the cable shield should be earthed through a 10 nF capacitor. If this is not possible, the shield is to be left unconnected.

**Stall Function**

The ACS 600 drive protects the motor upon a stall situation. It is possible to adjust the supervision limits (torque, frequency, time) and choose how the drive reacts to a motor stall condition (warning indication fault indication & stop; no reaction).

The protection is activated if all the following conditions are fulfilled at the same time:

1. The ACS 600 output frequency is below the Stall Frequency limit set by the user.

2. The motor torque has risen to the maximum allowed value (the value $T_{m,a}$ in the figure) calculated by the ACS 600 application program. This limit is continuously changing depending on variables such as the motor temperature calculated by the frequency converter software.

3. Conditions 1 and 2 have been fulfilled longer than the period set by the user (Stall Time Limit).

An alarm or fault function can be selected by Parameter 30.13 STALL FUNCTION. If FAULT is selected, a stall situation produces a fault “MOTOR STALL” and sets FW_2 (9.02) bit 14 to 1. If WARNING is selected, a stall situation produces a warning “MOTOR STALL” and sets AW_2 (9.05) bit 9 to 1.
Chapter 7 – Fault Tracing

Underload Function

The loss of motor load may indicate a process malfunction. The ACS 600 drive provides an Underload Function to protect the machinery and process in such a fault condition. The supervision limits (Underload Curve and Underload Time) can be chosen as well as the drive operation in an underload condition (warning indication; fault indication & stop; no reaction).

The protection is activated if all the following conditions are fulfilled at the same time:

1. The motor load is below the Underload Curve selected by the user.
2. The motor load has been below the selected Underload Curve longer than the time set by the user (Underload Time).
3. The ACS 600 drive output frequency is more than 10 % of the motor nominal frequency.

An alarm or fault function can be selected by Parameter 30.16 UNDERLOAD FUNC. If FAULT is selected, an underload situation produces a fault “UNDERLOAD” and sets FW_1 (9.01) bit 8 to 1. If WARNING is selected, an underload situation produces a warning “UNDERLOAD” and sets AW_2 (9.05) bit 1 to 1.

Motor Phase Loss Function

The Motor Phase Loss function monitors the status of the motor cable connections. The function is most useful during motor start. The ACS 600 drive detects if any of the motor phases have not been connected and refuses to start. The Phase Loss function also supervises the motor connection status during normal operation.

The user can define the operation upon motor phase loss. The alternatives are either a fault indication and Stop, or no reaction.

The fault indication is “MOTOR PHASE”. FW_2 (09.02) bit 15 is simultaneously set to a 1.
The Earth Fault protection detects earth faults in the motor, the motor cable or the inverter. The Earth Fault protection is based on earth leakage current measurement with a summation current transformer at the input of the converter. Depending on the user’s selection, the Earth Fault function stops the drive and gives a fault indication, or the drive continues operation and gives an alarm.

The tripping level of inverter sizes R10i…R12i can be selected by parameter 30.25 EARTH FAULT LEVEL. The parameter defines the unbalance trip level of sum current measured by the NINT board.

A fault function can be selected by selecting FAULT at parameter 30.20 EARTH FAULT. In case of fault, “EARTH FAULT” is indicated and FW_1 (09.01) bit 4 is set to 1. If NO is selected, an alarm “EARTH FAULT” is given and AW_1 (09.04) bit 14 is set to 1.

If the motor has an external cooling fan motor, it is possible to control the starter of the fan motor by digital output. See Parameter group 14 and 35. The diagnostics is activated by Parameter 35.01 MOTOR FAN CTRL. The acknowledge signal to the digital input from the motor starter is selected by Parameter 10.06 MOTOR FAN ACK.

1. When first starting the motor, if the motor fan acknowledge signal is not received within the time defined by parameter 35.02 FAN ACK DELAY, a fault is generated and the drive is tripped.

2. While running the motor:
   - If the acknowledge signal is lost, an alarm “MOTOR FAN” is generated. If the acknowledge signal is still lost after 35.02 FAN ACK DELAY, a fault is indicated and drive is tripped. If the acknowledge time is zero, only alarm is indicated.

3. AW_2 bit 0 is set to 1 in case of motor fan alarm.

4. FW_3 bit 0 is set to 1 in case of motor fan fault, if 35.01 MOTOR FAN CTRL has selection ALARM/FAULT.
## Fault and Alarm Messages

### Fault Message Table

<table>
<thead>
<tr>
<th>Alarm / Fault Text</th>
<th>Cause</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACS 600 TEMP</td>
<td>The ACx 600 internal temperature is excessive. A warning is given if inverter module temperature exceeds 115 °C.</td>
<td>Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.</td>
</tr>
<tr>
<td>AI&lt;MIN FUNC</td>
<td>I/O reference 4...20 mA is below 4mA level. (programmable fault or alarm, see Parameter 30.27).</td>
<td>Check for proper analogue control signal levels. Check the control wiring. Check AI &lt; MIN FUNC Fault Function parameters.</td>
</tr>
<tr>
<td>CABIN TEMP F</td>
<td>Cabinet over- or undertemperature detected on the NIOC-01 I/O board (thermistor). Environment temperature is too high (&gt;73 °C) or too low (&lt;5 °C).</td>
<td>Boost the cooling of air.</td>
</tr>
<tr>
<td>CABLE TEMP</td>
<td>Motor cable overtemperature trip. Thermal model of cable has reached 100% temperature level.</td>
<td>Check the motor load. Check the motor cable and its type. Verify with the cable thermal model parameters in Parameter Group 36.</td>
</tr>
<tr>
<td>CH0 COM LOS</td>
<td>Communication break detected on CH0 receive. (programmable fault, see Parameter 70.04)</td>
<td>Check the optical fibres between the NAMC board and overriding system (or fieldbus adapter). Test with new optical fibres. Check that the node address is correct in the drive. Check the status of the fieldbus adapter. See appropriate fieldbus adapter manual. Check parameter settings of Group 51, if a fieldbus adapter is present. Check the connections between the fieldbus and the adapter. Check that the bus master is communicating and correctly configured.</td>
</tr>
<tr>
<td>CH2 COM LOS</td>
<td>Communication break detected on CH2 receive. (programmable fault or alarm, see parameter 70.13)</td>
<td>Check the optical fibres between the NAMC boards. Check that the optical fibre loop is closed. Test with new optical fibres.</td>
</tr>
</tbody>
</table>
## Chapter 7 – Fault Tracing

### Fault Messages

<table>
<thead>
<tr>
<th>Alarm / Fault Text</th>
<th>Cause</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DC OVERVOLT</strong> 9.01 FW_1, bit 2</td>
<td>Intermediate circuit DC voltage is excessive. This can be caused by 1. Static or transient overvoltages in the mains. 2. Faulty braking chopper or resistor (if used). 3. Deceleration time being too short, if there is no braking chopper or regenerative incoming section. 4. Internal fault in the inverter unit.</td>
<td>Check the functioning of the braking chopper. If using a regenerative incoming section check that the diode mode is not forced during deceleration. Check the level of DC voltage and inverter nominal voltage. Replace the NINT-xx board (its voltage measurement circuit is faulty).</td>
</tr>
<tr>
<td><strong>DC UNDERVOLT</strong> 9.02 FW_2, bit 2</td>
<td>Intermediate circuit DC voltage is not sufficient. This can be caused by a missing mains phase in the diode rectifying bridge.</td>
<td>Checks mains supply and inverter fuses. If Standard HW is used, check that digital input DI2 is on 1, when the inverter is powered.</td>
</tr>
<tr>
<td><strong>DDF FORMAT</strong> 9.03 SFW, bit 3</td>
<td>File error in FLASH memory.</td>
<td>Replace the NAMC board.</td>
</tr>
<tr>
<td><strong>EARTH FAULT</strong> 9.01 FW_1, bit 4</td>
<td>The load on the incoming mains system is out of balance. This can be caused by a fault in the motor, motor cable or an internal malfunction. (programmable fault, see parameter 30.20) Tripping level setting is too sensitive in the non parallel connected R10i…R12i inverters. Check Parameter 30.25.</td>
<td>Check motor. Check motor cable. Check that there are no power factor correction capacitors or surge absorbers in the motor cable.</td>
</tr>
<tr>
<td><strong>ENCODER FLT</strong> 9.02 FW_2 bit 5</td>
<td>Speed measurement fault detected. This can be caused by loose cable connection, communication time-out, faulty pulse encoder, or too great a difference between the internal and measured actual speeds. (programmable fault or alarm, see Parameter 50.05)</td>
<td>Check settings of Parameter Group 50. Check pulse encoder and its cabling including Ch A and Ch B phasing. The sign of the signal 1.03 SPEED MEASURED must be same as internal actual speed 1.02 MOTOR SPEED when rotating the motor. If not, exchange channels A and B. Check fibre optic connection between the NAMC board and the NTAC-0x module. Check the proper earthing of equipment. Check for highly emissive components nearby.</td>
</tr>
<tr>
<td><strong>FACTORY FILE</strong> 9.03 SFW bit 0</td>
<td>Factory macro parameter file error.</td>
<td>Replace the NAMC board.</td>
</tr>
<tr>
<td><strong>FLT (xx)</strong> 8.01 MSW bit 3</td>
<td>There is an internal fault in the ACS 600.</td>
<td>Check for loose connections inside of frequency converter cabinet. Write down the Fault code (in brackets). Contact ABB Service.</td>
</tr>
<tr>
<td>Alarm / Fault Text</td>
<td>Cause</td>
<td>What to do</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------</td>
<td>------------</td>
</tr>
</tbody>
</table>
| **ID RUN FLT** 8.01 MSW bit 3 | Motor ID Run not possible due to the limits or locked rotor. | Check that no overriding system is connected to the drive. Switch off the auxiliary voltage supply from the NAMC board and power up again.  
Check the parameter values in Group 20. - Check that no limits prevent the ID Run.  
Restore factory settings and try again.  
Check that the motor shaft is not locked. |
| **IO FAULT** 9.02 FW_2 bit 6 | I/O communication fault or error detected on CH1. This can be caused by a fault in the I/O unit, a fibre optic cable connection problem or incorrect module identification number (if I/O extension modules are present). | Check for loose connections between the NIOC-01 or extension module and NAMC board. Measure that every I/O unit receives +24 V DC auxiliary voltage.  
Test with new optic fibre cables.  
Check the identification numbers of extension I/O modules.  
If the fault is still active, replace the I/O board/extension unit(s). |
| **KLIXON** 9.01 FW_1 bit 5 | Motor 1 or 2 overtemperature fault. A thermal switch or thermistor connected to DI6 has opened. Also PTC thermistor connected to DI6 of NIOC-01 detects motor overtemperature. | Check motor ratings and load.  
Check cable.  
Check thermistor (only to DI6 of NIOC-01) or thermal switch connections to digital inputs. If the resistance of the thermistor is over 4 kΩ, real overtemperature occurs in the motor. Wait until the motor has cooled. The state of DI6 returns back to 1 when the resistance of the thermistor is between 0...1.5 kΩ.  
Replace the I/O board if the voltage in the selected KLIXON digital input is correct, but the state of DI6 is 0 in 1.15 DI6-1 STATUS or 8.03 DI STATUS WORD.  
Check Parameter 10.05 KLIXON. |
| **MOTOR TEMP M** 9.01 FW_1 bit 5 | Motor 1 or 2 overtemperature fault. (PT100 or PTC measurement to analogue I/O). Motor temperature has exceeded the tripping level. (programmable fault or alarm, see Parameter 30.02) | Check motor ratings, load and cooling. Check start-up data. Check MOTOR TEMP Fault Function parameters.  
If an NAIO module is used for temperature measurement, check its DIP switch settings as well as Parameter 98.06 AIO EXT MODULE 1. |
## FAULT MESSAGES

<table>
<thead>
<tr>
<th>Alarm / Fault Text</th>
<th>Cause</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTOR FAN 9.06 FW_3 bit 0</td>
<td>Acknowledge signal is missing from the external motor fan starter.</td>
<td>Check the acknowledge circuit connection to the selected digital input. Check Parameter 35.02. Check the overload protection device of the fan motor. If it has tripped, reset it. Check the condition of the bearings of the fan motor by rotating fan motor manually. Replace the spare part fan if faulty. Replace the spare part fan if overload trippings continue and the bearings are OK.</td>
</tr>
<tr>
<td>MOTOR PHASE 9.02 FW_2 bit 15</td>
<td>Fault in the motor circuit. One of the motor phases is lost. This can be caused by a fault in the motor, the motor cable, a thermal relay (if used), or an internal fault. (programmable fault or alarm, see Parameter 30.19).</td>
<td>Check motor and motor cable. If the motor is disconnected, this fault is activated. Check thermal relay (if used). Check MOTOR PHASE Fault Function parameters. Disable this protection. If the cable and motor is ok, this fault can appear with small motors (&lt;30 kW) in low speed. Deactivate protection in this case.</td>
</tr>
<tr>
<td>MOTOR STALL 9.02 FW_2 bit 14</td>
<td>Motor or process stall. Motor is operating in the stall region. This can be caused by excessive load or insufficient motor power. (programmable fault or alarm, see Parameter 30.13)</td>
<td>Check motor load and the ACx 600 ratings. Check MOTOR STALL Fault Function parameters (30.13 ... 30.15).</td>
</tr>
<tr>
<td>MOTOR TEMP 9.01 FW_1 bit 6</td>
<td>Overtemperature fault (thermal model). Temperature has exceeded the tripping level of the thermal model. (programmable fault or alarm, see parameter 30.02)</td>
<td>Check motor ratings, load and cooling. Check start-up data. Check MOTOR TEMP Fault Function parameters.</td>
</tr>
<tr>
<td>NVOS ERROR 9.03 SFW bit 2</td>
<td>Non-volatile operating system error.</td>
<td>Replace the NAMC board.</td>
</tr>
<tr>
<td>OVER SWFREQ 9.02 FW_2 bit 9</td>
<td>Over switching frequency fault. This may be due to a hardware fault in the electronics boards.</td>
<td>Replace the NAMC board. Replace the NINT board. On units with parallel connected inverters, replace the NPBU board.</td>
</tr>
</tbody>
</table>
## FAULT MESSAGES

<table>
<thead>
<tr>
<th>Alarm / Fault Text</th>
<th>Cause</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OVERCURRENT</strong> 9.01 FW_1 bit 1</td>
<td>Overcurrent has been detected.</td>
<td>If the drive tripped during flying start, check that Parameter 21.01 START FUNCTION is set to AUTO. (Other modes do not support flying start). Check motor load. Check acceleration time. Check motor and motor cable (including phasing). Check pulse encoder and pulse encoder cable. Check that there are no power factor correction capacitors or surge absorbers in the motor cable. Check the nominal motor values from Group 99 to confirm that the motor model is correct.</td>
</tr>
<tr>
<td><strong>OVERFREQ</strong> 9.01 FW_1 bit 9</td>
<td>Motor is turning faster than the highest allowed speed. This can be caused by an incorrect setting of parameters, insufficient braking torque or changes in the load when using torque reference.</td>
<td>Check the minimum and maximum speed settings. Check the adequacy of motor braking torque. Check the applicability of torque control. Check the need for a Braking Chopper and Braking Resistor if the drive has a Diode Supply Unit DSU. Check Parameter 20.11 FREQ TRIP MARGIN.</td>
</tr>
<tr>
<td><strong>PANEL LOST</strong> 9.02 FW_2 bit 13</td>
<td>A Local Control device (CDP 312 or DriveWindow) has ceased communicating. This can be caused by the disconnection of the selected local control device during local control or an internal fault in the local controlling device. (programmable fault or alarm, see parameter 30.21)</td>
<td>Check Control Panel connector. Replace Control Panel in the mounting platform. Check PANEL LOST Fault Function parameters.</td>
</tr>
<tr>
<td><strong>PPCC LINK</strong> 9.02 FW_2 bit 11</td>
<td>NINT board current measurement or communication fault between the NAMC and NINT boards. (This fault can be masked, if the DC intermediate circuit voltage has been disconnected, but the NAMC board has an external power supply and fault indication is not needed. The Fault appears only if the motor is start. See Parameter 30.24)</td>
<td>Check the fibre optic cables connected between the NAMC and NINT boards. In parallel connected inverters, also check the cabling on the NPBU-xx board. If the fault is still active, replace the NPBU board (only with parallel connected inverters), NAMC and NINT board (in this order) until the fault disappears. Test with new fibre optic cables in the PPCC link. Check that there is no short circuit in the power stage. The short circuit or over current can cause this message due to the possible faulty power plate. It can causes possible overloading for auxiliary power and as a result PPCC link communication failure.</td>
</tr>
<tr>
<td>Alarm / Fault Text</td>
<td>Cause</td>
<td>What to do</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>RUN DISABLD 9.02 FW_2 bit 4</td>
<td>External interlocking (DI2=0) circuit is open. There is a fault in the external devices.</td>
<td>Check the circuit connected to digital input DI2.</td>
</tr>
<tr>
<td>SAFETY SWITC</td>
<td>The motor is running and safety switch is opened.</td>
<td>Close the safety switch. Reset the fault and start the motor again.</td>
</tr>
<tr>
<td>SC (INU 1) 9.01 FW_1 bit 12</td>
<td>Short Circuit in (parallel connected) inverter unit 1</td>
<td>Short circuit detected in parallel connected inverter unit 1. Check the optic fibre connection from the NPBU-xx board channel CH1 (INT1) to the inverter. Check the motor and motor cable. Check all power plates in inverter unit 1. If a faulty power plate is detected, replace the whole phase module by another.</td>
</tr>
<tr>
<td>SC (INU 2) 9.01 FW_1 bit 13</td>
<td>Short Circuit in (parallel connected) inverter unit 2</td>
<td>Short circuit detected in the parallel connected inverter unit 2. Check the optic fibre connection from the NPBU-xx board channel CH2 (INT2) to the inverter. Check the motor and motor cable. Check all power plates in inverter unit 2. If a faulty power plate is detected, replace the whole phase module by another.</td>
</tr>
<tr>
<td>SC (INU 3) 9.01 FW_1 bit 14</td>
<td>Short Circuit in (parallel connected) inverter unit 3</td>
<td>Short circuit detected in the parallel connected inverter unit 3. Check the optic fibre connection from the NPBU-xx board channel CH3 (INT3) to the inverter. Check the motor and motor cable. Check all power plates in inverter unit 3. If a faulty power plate is detected, replace the whole phase module by another.</td>
</tr>
<tr>
<td>SC (INU 4) 9.01 FW_1 bit 15</td>
<td>Short Circuit in (parallel connected) inverter unit 4</td>
<td>Short circuit detected in the parallel connected inverter unit 4. Check the optic fibre connection from the NPBU-xx board channel CH4 (INT4) to the inverter. Check the motor and motor cable. Check all power plates in inverter unit 4. If a faulty power plate is detected, replace the whole phase module by another.</td>
</tr>
<tr>
<td>SHORT CIRC 9.01 FW_1 bit 0</td>
<td>Short circuit has been detected. The output current is excessive.</td>
<td>Check the motor and motor cable. Measure the resistances of the power plate(s). If a faulty power plate is detected, replace the power plate and the NINT and NGDR boards or the whole inverter phase module. Check that the prevention of unexpected start-up circuit has not opened during the run.</td>
</tr>
</tbody>
</table>
## Fault Messages

*in alphabetical order*

<table>
<thead>
<tr>
<th>Alarm / Fault Text</th>
<th>Cause</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>START INH HW</td>
<td>Start Inhibit HW fault has been detected in the Prevention of Unexpected Start-Up circuit.</td>
<td>Check that the LED indicator is ON in the NGPS-xx power supply, when powered. If not, change the NGPS-xx power supply. Check the digital input connection in the START INHIB DI circuit according to parameter selection 10.08. Check the status of START INHIB DI in the HW by measuring the voltage between the input terminals. Check the SW status from the signal DI STATUS WORD (8.05). If there is a voltage in the input terminals of START INHIB DI, but the DI STATUS WORD (8.05) indicates state FALSE, change the I/O board / module.</td>
</tr>
<tr>
<td>SUPPLY PHASE</td>
<td>Ripple voltage in the DC link is too high. This can be caused by a missing mains phase in the diode rectifier bridge, or DC voltage oscillation by a thyristor rectifying bridge (if used in the incoming section).</td>
<td>Check for mains supply imbalance. Check the mains fuses.</td>
</tr>
<tr>
<td>UNDERLOAD</td>
<td>Process underload situation detected. Motor load is too low. This can be caused by a release mechanism in the driven equipment. (programmable fault or alarm, see Parameter 30.16.)</td>
<td>Check the driven equipment. Check UNDERLOAD Fault Function parameters.</td>
</tr>
<tr>
<td>USER MACRO</td>
<td>User Macro parameter file error. There is no User Macro saved or the file is defective.</td>
<td>Create the User Macro again.</td>
</tr>
</tbody>
</table>
## Alarm Message Table

<table>
<thead>
<tr>
<th>Alarm Message</th>
<th>Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACS 600 TEMP</strong></td>
<td>Power plate overtemperature alarm. The ACS 600 internal temperature is excessive.</td>
<td>Check ambient conditions. Check airflow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.</td>
</tr>
<tr>
<td>9.04 AW_1 bit 4</td>
<td>I/O reference 4...20 mA is below 4 mA. (programmable fault or alarm, see parameter 30.27).</td>
<td>Check for proper analogue control signal levels. Check the control wiring. Check AI &lt; MIN FUNC Fault Function parameters.</td>
</tr>
<tr>
<td><strong>AIO ALARM</strong></td>
<td>Analogue I/O error detected on the Standard I/O board NIOC-01.</td>
<td>Replace the NIOC-01 board. Test with new fibre optic cables on CH1.</td>
</tr>
<tr>
<td>9.04 AW_1 bit 8</td>
<td>There is an internal alarm in the ACS 600.</td>
<td>Check for loose connections inside of frequency converter cabinet. Write down the Alarm code (in brackets). Contact ABB Service.</td>
</tr>
<tr>
<td><strong>ALM (xx)</strong></td>
<td>There is an internal alarm in the ACS 600.</td>
<td>Check for loose connections inside of frequency converter cabinet. Write down the Alarm code (in brackets). Contact ABB Service.</td>
</tr>
<tr>
<td>8.01 MSW bit 7</td>
<td>Motor cable overtemperature alarm. Thermal model of the cable has reached 90% temperature level.</td>
<td>Check the motor load. Check the motor cable and its type and verify the cable thermal model parameters from the parameter group 36.</td>
</tr>
<tr>
<td><strong>CABLE TEMP</strong></td>
<td>Motor cable overtemperature alarm. Thermal model of the cable has reached 90% temperature level.</td>
<td>Check the motor load. Check the motor cable and its type and verify the cable thermal model parameters from the parameter group 36.</td>
</tr>
<tr>
<td>8.05 AW_2 bit 3</td>
<td>Communication break detected on CH0 receive. CONSTANT SPEED1 mode selected with Par. 70.05. (can be deactivated: see Parameter 70.04)</td>
<td>Check the fibre optic cables between the NAMC board and the overriding system (or fieldbus adapter). Test with new fibre optic cables on CH0. Check that the node address is correct for the drive. Check the status of the fieldbus adapter. See appropriate fieldbus adapter manual. Check parameter settings of Group 51 in case of FBA module and connections between control system and adapter module. Check if the bus master is not communicating or configured.</td>
</tr>
<tr>
<td><strong>CH0 TIMEOUT</strong></td>
<td>Communication break detected on CH0 receive. CONSTANT SPEED1 mode selected with Par. 70.05. (can be deactivated: see Parameter 70.04)</td>
<td>Check the fibre optic cables between the NAMC board and the overriding system (or fieldbus adapter). Test with new fibre optic cables on CH0. Check that the node address is correct for the drive. Check the status of the fieldbus adapter. See appropriate fieldbus adapter manual. Check parameter settings of Group 51 in case of FBA module and connections between control system and adapter module. Check if the bus master is not communicating or configured.</td>
</tr>
<tr>
<td><strong>CH2 COM LOS</strong></td>
<td>Communication break detected on CH2 receive. (programmable fault or alarm; see Parameter 70.13)</td>
<td>Check the fibre optic cables on CH2 between the NAMC boards. Check that the fibre optic loop is closed. Test with new fibre optic cables on CH2. Check that there is one master drive and the remainder are followers in the M/F link. See Parameter 70.08 CH2 M/F MODE.</td>
</tr>
</tbody>
</table>
## ALARM MESSAGES

<table>
<thead>
<tr>
<th>Alarm Message</th>
<th>Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC UNDERVOLT</td>
<td>An undervoltage trip has been detected with the Auto Restart function. This is indicated to the AW2 diagnostics.</td>
<td>n.a. Only indication.</td>
</tr>
<tr>
<td>DIO ALARM</td>
<td>Digital input malfunction detected in the I/O board NIOC-01.</td>
<td>Check the fibre optic cables. Test with new fibre optic cables on CH1. Replace the NIOC-01 board.</td>
</tr>
<tr>
<td>EARTH FAULT</td>
<td>The load on the incoming mains system is out of balance. This can be caused by a fault in the motor, motor cable or an internal malfunction. (programmable fault or alarm; see Parameter 30.20) Tripping level setting is too sensitive in the R10i… R12i inverters. See Parameter 30.25.</td>
<td>Check motor. Check motor cable. Check that there are no power factor correction capacitors or surge absorbers in the motor cable.</td>
</tr>
<tr>
<td>EM STOP</td>
<td>Emergency Stop has been activated either by digital input DI1( = 0) or MAIN CONTROL WORD 7.01 bit 2 (= 0).</td>
<td>Emergency stop push buttons must be returned to their normal position after the emergency stop situation is over. Check that the overriding system keeps sending the MAIN CONTROL WORD to drive. See bit 2 of MCW. To get drive to ready status, the MCW bit 0 must be set to state FALSE and back to TRUE.</td>
</tr>
<tr>
<td>ENCODER ERR</td>
<td>Speed measurement alarm detected. This can be caused by a loose cable connection or faulty pulse encoder. (programmable fault or alarm, see parameter 50.05)</td>
<td>Check settings of Parameter Group 50. Check the pulse encoder and its cabling (including CH A and CH B phasing). The sign of signal 1.03 SPEED MEASURED must be the same as internal actual speed 1.02 SPEED ESTIMATED. If it is not, reverse the channels A and B. Check fibre optic connection between the NAMC board and the NTAC-0x module. Check the proper earthing of equipment. Check for highly emissive components nearby.</td>
</tr>
<tr>
<td>EXT AIO ALM</td>
<td>Analogue I/O error detected in the NAIO I/O Extension module</td>
<td>If the alarm is continuously active, replace the NAIO module.</td>
</tr>
<tr>
<td>EXT DIO ALM</td>
<td>Digital input error detected in the NDIO I/O Extension module.</td>
<td>If the alarm is continuously active, replace the NDIO module.</td>
</tr>
<tr>
<td>INV OVERLOAD</td>
<td>Forced cooling cycle for inverter is active after the overloading cycle 10/60s.</td>
<td>Load is too high. Check the dimensioning and process.</td>
</tr>
</tbody>
</table>
### ALARM MESSAGES

(in alphabetical order)

<table>
<thead>
<tr>
<th>Alarm Message</th>
<th>Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/F CONNECT Fault Logger</td>
<td>Wrong data type has been selected at parameters MASTER REF 1, 2 or 3 (70.09...70.11)</td>
<td>Select zero or correct data type at the following parameters: 70.09 packed boolean 70.10 real or integer 70.11 real or integer</td>
</tr>
<tr>
<td>MOTOR TEMP M 9.04 AW_1 bit 2</td>
<td>Motor 1 or 2 overtemperature alarm (PT100 or PTC measurement to Analogue I/O) (programmable fault or alarm; see Parameter (30.01, 30.03...30.05)</td>
<td>Check motor ratings and load. Check start-up data. Check PT100 or thermistor connections for AI and AO of the NIOC-01 board or NAIO extension module according to the hardware configuration. Check the DIP switches and selection of parameter 98.06 AIO EXT MODULE 1, if an NAIO extension module is used for temperature measurement.</td>
</tr>
<tr>
<td>MOTOR FAN 9.05 AW_2 bit 0</td>
<td>Acknowledge signal is missing from the external motor fan and an alarm is present the time defined by Parameter 35.03 FAN ACK DELAY.</td>
<td>Check the acknowledge circuit on the selected digital input. See Parameter 35.02. Check the overload protection device of the fan motor. If it has tripped, reset it. Check the condition of the bearings of the fan motor by rotating the fan motor manually. Replace the spare part fan if faulty. Replace the spare part fan if overload trippings continue and the bearings are OK.</td>
</tr>
<tr>
<td>MOTOR STALL 9.05 AW_2 bit 9</td>
<td>Motor or process stall. Motor operating in the stall region. This can be caused by excessive load or insufficient motor power. (programmable fault or alarm; see Parameter 30.13)</td>
<td>Check motor load and the ACx 600 ratings. Check MOTOR STALL Fault Function parameters.</td>
</tr>
<tr>
<td>MOTOR STARTS</td>
<td>Motor ID Run has been selected and the drive started in the Local control mode.</td>
<td>Wait until the Motor ID Run is complete.</td>
</tr>
<tr>
<td>MOTOR TEMP 9.04 AW_1 bit 3</td>
<td>Overtemperature alarm (thermal model). Temperature has exceeded the alarm level of the thermal model. (programmable fault or alarm; see Parameter 30.02)</td>
<td>Check motor ratings, load and cooling. Check Parameter 30.28 THERM MOD ALM L. If USER MODE is selected, check that Parameters 30.09 ... 30.12 are set correctly.</td>
</tr>
<tr>
<td>NO MOTOR DATA 9.02 FW_2 bit 1</td>
<td>Motor data is not given or motor data does not match with inverter data.</td>
<td>Check the motor data given by Parameters 99.02...99.06.</td>
</tr>
</tbody>
</table>
### ALARM MESSAGES

<table>
<thead>
<tr>
<th>Alarm Message</th>
<th>Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>PANEL LOST</td>
<td>A Local Control device (CDP 312 or DriveWindow) has ceased communicating. This can be caused by the disconnection of the selected local control device during local control or an internal fault in the local controlling device. (programmable fault or alarm, see parameter 30.21)</td>
<td>Check Control Panel connector. Replace Control Panel in the mounting platform. Check PANEL LOST Fault Function parameters.</td>
</tr>
<tr>
<td>POWDOWN FILE</td>
<td>Error in restoring powerdown.ddf file</td>
<td>If the alarm keeps reappearing, replace the NAMC-xx board.</td>
</tr>
<tr>
<td>POWFAIL FILE</td>
<td>Error in restoring powerfail.ddf file</td>
<td>If the alarm keeps reappearing, replace the NAMC-xx board.</td>
</tr>
<tr>
<td>RESTARTED</td>
<td>The motor has been restarted after the short net break with AUTO RESTART function. See parameter 21.09.</td>
<td>n.a.</td>
</tr>
<tr>
<td>SAFETY SWITC</td>
<td>The motor has been stopped and safety switch is opened.</td>
<td>Close the safety switch.</td>
</tr>
<tr>
<td>START INHIBI</td>
<td>Prevention of unexpected start-up activated from the hardware typically by operator for equipment maintenance.</td>
<td>The Operator must close the prevention of unexpected start-up switch. If the switch is closed and the alarm is still active, check that the “Power On” LED is lit on the NGPS board. If the LED is off but there is a voltage at the input terminals of the NGPS, replace the board.</td>
</tr>
<tr>
<td>T MEAS ALM</td>
<td>Motor temperature measurement circuit is faulty. This can be caused by a broken temperature sensor or cable.</td>
<td>Check the motor temperature sensor connections.</td>
</tr>
<tr>
<td>UNDERLOAD</td>
<td>Process underload situation detected. Motor load is too low. This can be caused by a release mechanism in the driven equipment. (programmable fault or alarm; see Parameter 30.16)</td>
<td>Check for a problem in the driven equipment. Check UNDERLOAD Fault Function parameters.</td>
</tr>
</tbody>
</table>
### Event Messages

<table>
<thead>
<tr>
<th>EVENT MESSAGES</th>
<th>(in alphabetical order)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Event Message</strong></td>
<td><strong>Cause</strong></td>
</tr>
<tr>
<td>SYSTEM START</td>
<td>Inverter Software has been started. This indicates normally an auxiliary voltage on connection.</td>
</tr>
</tbody>
</table>

### Other Messages

<table>
<thead>
<tr>
<th>OTHER MESSAGES</th>
<th>(in alphabetical order)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alarm Message</strong></td>
<td><strong>Cause</strong></td>
</tr>
<tr>
<td>NO COMMUNICATION</td>
<td>Control Panel CDP 312 message. The selected drive is not present on the link. The link does not work because of a hardware malfunction or problem in the cabling.</td>
</tr>
<tr>
<td>SWC ON INHIB 8.01 MSW bit 6</td>
<td>Drive is in the ON INHIBIT state. See ABB Drive Profile description.</td>
</tr>
<tr>
<td>ID N CHANGED</td>
<td>Modbus ID number of the drive has been changed from 1 in Drive Selection Mode of CDP 312 panel (the change is not shown on the display).</td>
</tr>
<tr>
<td>MACRO CHANGE</td>
<td>A Macro is being restored or a user Macro is being saved.</td>
</tr>
<tr>
<td>ID MAGN REG</td>
<td>The ACx 600 is ready to start identification magnetisation.</td>
</tr>
<tr>
<td>ID MAGN</td>
<td>The ACx 600 is performing identification magnetisation.</td>
</tr>
<tr>
<td>ID DONE</td>
<td>The ACx 600 has performed the identification magnetisation and is ready to start.</td>
</tr>
<tr>
<td>I/O SP REF</td>
<td>AI1 of NIOC-01 has been selected incorrectly for speed reference and motor temperature measurement when I/O control (98.02 = NO) or HAND/AUTO function has been selected.</td>
</tr>
</tbody>
</table>
## Chapter 8 - Terms

<table>
<thead>
<tr>
<th>TERMS</th>
<th>FULL NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACS</td>
<td>AC Standard</td>
<td>ABB standard frequency converter family. E.g. ACS 600.</td>
</tr>
<tr>
<td>ACS 600</td>
<td></td>
<td>ACS 600 frequency converter family.</td>
</tr>
<tr>
<td>ACS 600 MultiDrive</td>
<td></td>
<td>System drive; a member of ACS 600 product family.</td>
</tr>
<tr>
<td>ACU</td>
<td>Auxiliary Control Unit</td>
<td>Interface for an analogue input signal.</td>
</tr>
<tr>
<td>AI</td>
<td>Analogue Input</td>
<td>E.g. NAMC table. The interface between application SW and motor control SW in ACS 600.</td>
</tr>
<tr>
<td>NAMC</td>
<td>Application and Motor Control</td>
<td>Control board for ACS 600 and ACS 600 MultiDrive.</td>
</tr>
<tr>
<td>NAMC Control Board</td>
<td>Application and Motor Controller board</td>
<td>Control board for ACS 600 and ACS 600 MultiDrive.</td>
</tr>
<tr>
<td>AO</td>
<td>Analogue Output</td>
<td>Interface for an analogue output signal.</td>
</tr>
<tr>
<td>APC2</td>
<td>Application Program Controller</td>
<td>System drives application controller (board).</td>
</tr>
<tr>
<td>AC 80</td>
<td>Application Program Controller</td>
<td>System drives application controller.</td>
</tr>
<tr>
<td>ASIC</td>
<td>Application Specific Integrated Circuit</td>
<td>Non-standard IC circuits. Allow more compact and cheaper PCB design than using standard circuits.</td>
</tr>
<tr>
<td>BJT</td>
<td>Bipolar Junction Transistor</td>
<td>Semiconductor type.</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer Aided Design</td>
<td>APC 2, DDC and optional boards.</td>
</tr>
<tr>
<td>CDC</td>
<td>Common Drive Control</td>
<td>APC 2, DDC and optional boards.</td>
</tr>
<tr>
<td>CDP 311</td>
<td>Common Drives Panel 311</td>
<td>Control panel is used to parametrise and monitor ACS 600 using CDI-protocol.</td>
</tr>
<tr>
<td>CDP 312</td>
<td>Common Drives Panel 312</td>
<td>Control panel is used to parametrise and monitor ACS 600 using Modbus-protocol.</td>
</tr>
<tr>
<td>CE Marking</td>
<td>Communauté Européenne Marking</td>
<td>CE marking: The product complies with the requirements of relevant European Directives.</td>
</tr>
<tr>
<td>CMOS</td>
<td>Complementary MOS</td>
<td>Semiconductor type.</td>
</tr>
<tr>
<td>DC Busbar</td>
<td></td>
<td>Direct Current supply for inverter units.</td>
</tr>
<tr>
<td>DDC</td>
<td>Digital Drive Controller</td>
<td>Standard control functions, torque and speed control loops, internal start/stop logic, internal fault diagnostic, motor and cable protection.</td>
</tr>
<tr>
<td>DDCC</td>
<td>Distributed Drives Communication Circuit</td>
<td>Communication ASIC used in ACS 600 products.</td>
</tr>
<tr>
<td>DDCS</td>
<td>Distributed Drives Communication System</td>
<td>Communication protocol used in ACS 600 products.</td>
</tr>
<tr>
<td>TERMS</td>
<td>FULL NAME</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>DDC</td>
<td>Digital Drive Controller Tool</td>
<td>Window based PC tool. Optically connected to the DDC, setting/monitoring DDC’s parameters local control of DDC, monitoring actual values, testing DDC I/O’s.</td>
</tr>
<tr>
<td>DI</td>
<td>Digital Input</td>
<td>Interface for a digital input signal.</td>
</tr>
<tr>
<td>DO</td>
<td>Digital Output</td>
<td>Interface for a digital output signal.</td>
</tr>
<tr>
<td>DriveSize</td>
<td>Digital Output</td>
<td>Dimensioning PC tool for optional selection of ACS 600 and motors.</td>
</tr>
<tr>
<td>DriveSupport</td>
<td>Digital Output</td>
<td>Servicing, maintaining and troubleshooting tool for ACS 600 product family.</td>
</tr>
<tr>
<td>DriveWindow</td>
<td>Digital Output</td>
<td>PC tool for operating, controlling, parametrising and monitoring ABB drives (ACS 600).</td>
</tr>
<tr>
<td>DSP</td>
<td>Digital Signal Processor</td>
<td>Processor type used in NAMC board of ACS 600 product family.</td>
</tr>
<tr>
<td>DSU</td>
<td>Diode Supply Unit</td>
<td>Diode rectifying type of incoming supply.</td>
</tr>
<tr>
<td>DTC</td>
<td>Direct Torque Control</td>
<td>Revolutionary motor and inverter control method utilised first in ACS 600 product family.</td>
</tr>
<tr>
<td>EEPROM</td>
<td>Electrically Erasable Programmable ROM</td>
<td>Non volatile memory. Look abbreviation: ROM.</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic Compatibility</td>
<td>The ability of electrical equipment to operate problem-free in electromagnetic environment. Likewise, the equipment must not disturb other products/systems.</td>
</tr>
<tr>
<td>EMI</td>
<td>Electromagnetic Interference</td>
<td></td>
</tr>
<tr>
<td>EPROM</td>
<td>Erasable Programmable ROM</td>
<td>See: ROM.</td>
</tr>
<tr>
<td>ESD</td>
<td>ElectroStatic Discharge</td>
<td></td>
</tr>
<tr>
<td>FCB</td>
<td>Function Chart Builder</td>
<td>SW tool to make application programs (for ACS 600 and APC2).</td>
</tr>
<tr>
<td>FCE</td>
<td>Function Chart Editor</td>
<td>Editor of FCB used to draw application blocks.</td>
</tr>
<tr>
<td>FET</td>
<td>Field Effect Transistor</td>
<td>Semiconductor type.</td>
</tr>
<tr>
<td>Flash EEPROM</td>
<td>Electrically Sectorerasable EEPROM memory</td>
<td>Non volatile memory type.</td>
</tr>
<tr>
<td>FSR</td>
<td>Full Scale Range</td>
<td>E.g. the error is 0.01 % FSR (from maximum value).</td>
</tr>
<tr>
<td>GTO</td>
<td>Gate Turn-Off Thyristor</td>
<td>Semiconductor type.</td>
</tr>
<tr>
<td>HW</td>
<td>Hardware</td>
<td>Physical device or equipment.</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/Output</td>
<td>Control Input/Output signal (E.g. DI, DO, AI, AO).</td>
</tr>
<tr>
<td>IC</td>
<td>Integrated Circuit</td>
<td></td>
</tr>
<tr>
<td>IC</td>
<td>International Cooling</td>
<td>International cooling standard.</td>
</tr>
<tr>
<td>TERMS</td>
<td>FULL NAME</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>-------</td>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>ICMC</td>
<td>Integrated Control Motor Circuit</td>
<td>Motor and inverter control ASIC used in ACS 600.</td>
</tr>
<tr>
<td>ICU</td>
<td>Incoming Unit</td>
<td>Section through which the ACS 600 MultiDrive connects to the mains.</td>
</tr>
<tr>
<td>ID</td>
<td>Identification</td>
<td>E.g. ID run of ACS 600 to get initial motor parameters.</td>
</tr>
<tr>
<td>ID-run</td>
<td>Identification run</td>
<td>Start-up run to identify characteristics of a motor for optimum motor control.</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronic Engineers</td>
<td>US professional society that takes part in standardisation. E.g. IEEE Conference Reviews.</td>
</tr>
<tr>
<td>IGBT</td>
<td>Insulated Gate Bipolar Transistor</td>
<td>Power semiconductor used widely in frequency converters.</td>
</tr>
<tr>
<td>IM</td>
<td>International Mounting</td>
<td>International mounting standard.</td>
</tr>
<tr>
<td>IOCC</td>
<td>Input Output Control Circuit</td>
<td>I/O ASIC used in ACS 600 products.</td>
</tr>
<tr>
<td>IP</td>
<td>International Protection</td>
<td>Degree of protection provided by enclosures.</td>
</tr>
<tr>
<td>IR</td>
<td>IR stands for voltage. I(Current) x R(Resistance) = U(Voltage))</td>
<td>E.g. IR compensation: An extra voltage (torque) boost for a motor at low speeds.</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organisation for Standardisation</td>
<td>E.g. ISO 9000 series quality standards.</td>
</tr>
<tr>
<td>KLIXON switch</td>
<td>Temperature switch</td>
<td>Overtemperature monitoring sensor.</td>
</tr>
<tr>
<td>LCD</td>
<td>Liquid Crystal Display</td>
<td>Electronic display type used e.g. in CDP 312 Control Panel of ACS 600.</td>
</tr>
<tr>
<td>LCI</td>
<td>Load Committed Inverter</td>
<td>Some ABB Megadrive products are equipped with LCI (large synchronous motor drives).</td>
</tr>
<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
<td>Semiconductor type.</td>
</tr>
<tr>
<td>LMD-0X</td>
<td>Led Monitoring Display</td>
<td>Led display for monitoring ACS 600 Drive status and one signal.</td>
</tr>
<tr>
<td>Modbus</td>
<td>Fieldbus communication protocol.</td>
<td></td>
</tr>
<tr>
<td>NAC</td>
<td>Next AC drive</td>
<td>Common platform or basis for drives R&amp;D projects. ACS 600, MultiDrive, XT are based on NAC for example.</td>
</tr>
<tr>
<td>NAFA</td>
<td>NAC AF100 Adapter</td>
<td>Fieldbus option module of ACS 600.</td>
</tr>
<tr>
<td>NAIO</td>
<td>NAC Analogue Input/Output</td>
<td>Option module for ACS 600 to replace or extend analogue I/O channels.</td>
</tr>
<tr>
<td>NAMC</td>
<td>NAC NAMC Board</td>
<td>Motor and inverter control board of ACS 600.</td>
</tr>
<tr>
<td>NBRA</td>
<td>NAC Braking Chopper</td>
<td>Option device of ACS 600 for efficient braking with no regenerative input bridge.</td>
</tr>
<tr>
<td>NBRC</td>
<td>NAC Braking Chopper Controller Board</td>
<td>Board controlling the operation of braking chopper NBRA.</td>
</tr>
<tr>
<td>NCPC</td>
<td>NAC Control Panel Cable</td>
<td>Option cable for remote connection of the CDP 312 control panel.</td>
</tr>
<tr>
<td>NCSA</td>
<td>NAC CS 31 Adapter</td>
<td>Fieldbus option module of ACS 600.</td>
</tr>
</tbody>
</table>
## TERMS

<table>
<thead>
<tr>
<th>TERMS</th>
<th>FULL NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDIO</td>
<td>NAC Digital Input/Output</td>
<td>Option module for ACS 600 to replace or extend digital I/O channels.</td>
</tr>
<tr>
<td>NDNA</td>
<td>NAC DeviceNet Adapter</td>
<td>Fieldbus option module of ACS 600.</td>
</tr>
<tr>
<td>NDSC</td>
<td>NAC Diode Supply Unit</td>
<td>Control board for half controlled diode/thyristor input bridge.</td>
</tr>
<tr>
<td>NECG</td>
<td>NAC EMC Cable Glands</td>
<td>Optional add-on kit of ACS 601 (R3 to R6) for 360° cable shield earthing.</td>
</tr>
<tr>
<td>NED</td>
<td>Next Engineered Drive</td>
<td>R&amp;D project to develop engineered drive based on NAC platform. ACS 600 MultiDrive.</td>
</tr>
<tr>
<td>NGDR</td>
<td>NAC Gate Driver Board</td>
<td>PCB of ACS 600 for controlling the inverter IGBTs.</td>
</tr>
<tr>
<td>NIBA</td>
<td>NAC Interbus-S Adapter</td>
<td>Fieldbus option module of ACS 600.</td>
</tr>
<tr>
<td>NINP</td>
<td>NAC Input Bridge Board</td>
<td>PCB of ACS 600 for controlling the rectifier.</td>
</tr>
<tr>
<td>NINT</td>
<td>NAC Interface Electronics Board</td>
<td>PCB of ACS 600 for interfacing NAMC and Main Circuit.</td>
</tr>
<tr>
<td>NIOC</td>
<td>NAC Input Output Control Board</td>
<td>PCB of ACS 600 for connecting I/O and CDP 312 control panel to the drive.</td>
</tr>
<tr>
<td>NISA</td>
<td>NAC ISA/DDCS Adapter</td>
<td>Optional device of ACS 600. Placed to a PC's ISA board slot. Connects via fibres to NAMC.</td>
</tr>
<tr>
<td>NLWC</td>
<td>NAC Ligth Wave Cable</td>
<td>Optional add-on kit of ACS 600 (2 additional fibre optic cables).</td>
</tr>
<tr>
<td>NMBA</td>
<td>NAC Modbus Adapter</td>
<td>Fieldbus option module of ACS 600.</td>
</tr>
<tr>
<td>NMFA</td>
<td>NAC Master Fieldbus Adapter</td>
<td>Fieldbus option module of ACS 600.</td>
</tr>
<tr>
<td>NPBA</td>
<td>NAC Profibus Adapter</td>
<td>Fieldbus option module of ACS 600.</td>
</tr>
<tr>
<td>NPBU</td>
<td>NAC PPCS Branching Unit</td>
<td>Optical PPCS branching unit used when paralleling inverter modules.</td>
</tr>
<tr>
<td>NPMP</td>
<td>NAC Panel Mounting Platform</td>
<td>Optional add-on kit of ACS 600: A base onto which the control panel can be attached.</td>
</tr>
<tr>
<td>NPOW</td>
<td>NAC Power Supply Board</td>
<td>PCB of ACS 600 for powering other boards and option modules.</td>
</tr>
<tr>
<td>NPSM</td>
<td>NAC Power Supply Option</td>
<td>Option module of ACS 600 to power external devices.</td>
</tr>
<tr>
<td>NSNA</td>
<td>NAC SucoNet Adapter</td>
<td>Fieldbus option module of ACS 600.</td>
</tr>
<tr>
<td>NTAC</td>
<td>NAC Tacho (Encoder)</td>
<td>Option pulse encoder interface for ACS 600.</td>
</tr>
<tr>
<td>NTC</td>
<td>Negative Temperature Coefficient resistor</td>
<td>PCB of ACS 600 for input bridge protection.</td>
</tr>
<tr>
<td>NVAR</td>
<td>NAC Varistor Board</td>
<td>A standard layer model for open telecommunication systems.</td>
</tr>
<tr>
<td>OSI</td>
<td>Open System Interconnection</td>
<td>Wiring boards used in electronic devices.</td>
</tr>
<tr>
<td>PCB</td>
<td>Personal Computer Memory Card International Association</td>
<td>DDCS/PCMCIA interface enables connecting PC and Drives Window tool to ACS 600 series drive.</td>
</tr>
<tr>
<td>PE</td>
<td>Protective Earth</td>
<td>Terminal for grounding e.g. ACS 600.</td>
</tr>
<tr>
<td>TERMS</td>
<td>FULL NAME</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>PFC</td>
<td>Pump and Fan Control (Macro)</td>
<td>The macro of ACS 600 for controlling pump or fan sections.</td>
</tr>
<tr>
<td>PI</td>
<td>Proportional, Integral</td>
<td>Controller type.</td>
</tr>
<tr>
<td>PID</td>
<td>Proportional, Integral and Derivate</td>
<td>Controller type which allows to control customer's process'. (e.g. used in ACS 600 speed controller).</td>
</tr>
<tr>
<td>PLC</td>
<td>Programmable Logic Controller</td>
<td></td>
</tr>
<tr>
<td>PP</td>
<td>Power Plate</td>
<td>Inverter IGBTs, sensors and control circuits integrated into one component.</td>
</tr>
<tr>
<td>PPCC</td>
<td>Power Plate Control Circuit</td>
<td>ASIC of NINT board used for controlling PPs.</td>
</tr>
<tr>
<td>PPCS</td>
<td>Power Plate Communication System</td>
<td>Optical serial link for inverter control.</td>
</tr>
<tr>
<td>ppm</td>
<td>parts per million</td>
<td>$1/10^6$</td>
</tr>
<tr>
<td>ppr</td>
<td>pulses per revolution</td>
<td>Number of pulses given by incremental encoder per one revolution.</td>
</tr>
<tr>
<td>PROM</td>
<td>Programmable ROM</td>
<td>See: ROM.</td>
</tr>
<tr>
<td>PT100</td>
<td>Platinum Wire Resistance Element 100</td>
<td>Temperature dependent resistor used e.g. in AC-motors to indicate motor temperature. $R = 100$ ohm at $0^\circ$.</td>
</tr>
<tr>
<td>PTC</td>
<td>Positive Temperature Coefficient resistor</td>
<td>PTC thermistor is a semi-conductor used to indicate exceeded temperature limit.</td>
</tr>
<tr>
<td>PWM</td>
<td>Pulse Width Modulation</td>
<td>The traditional control method of inverter.</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
<td></td>
</tr>
<tr>
<td>R2, ..., R9</td>
<td>Frame size 2 - 9</td>
<td>ACS 600/500 series: Size of the frame inside which the converter unit is assembled.</td>
</tr>
<tr>
<td>RAM</td>
<td>Random Access Memory</td>
<td>Volatile memory.</td>
</tr>
<tr>
<td>RFI</td>
<td>Radio Frequency Interference</td>
<td></td>
</tr>
<tr>
<td>RMS</td>
<td>Rated Mean Squareroot</td>
<td>For sini wave the RMS value is maximum value divided by squareroot of 2. E.g. 4 A RMS: Effective value is four amperes.</td>
</tr>
<tr>
<td>RO</td>
<td>Relay Output</td>
<td>Interface for a digital output signal. Implemented with a relay.</td>
</tr>
<tr>
<td>ROM</td>
<td>Read Only Memory</td>
<td>Non volatile memory component type used e.g. in NAMC of ACS 600.</td>
</tr>
<tr>
<td>RS 232</td>
<td></td>
<td>Standard for data transmission physical interface (signal usage &amp; other electrical parameters).</td>
</tr>
<tr>
<td>RS 485</td>
<td></td>
<td>Standard for data transmission physical interface (signal levels &amp; other electrical parameters).</td>
</tr>
<tr>
<td>SCR</td>
<td>Silicon Controlled Rectifier</td>
<td>Semiconductor type similar to thyristor.</td>
</tr>
<tr>
<td>SDCS UCM-1</td>
<td>UC-resistor board</td>
<td>Used in TSU.</td>
</tr>
<tr>
<td>SDCS-COM-1</td>
<td>Communication board</td>
<td>Used in TSU.</td>
</tr>
<tr>
<td>SDCS-CON-1</td>
<td>Control board</td>
<td>Used in TSU.</td>
</tr>
<tr>
<td>SDCS-IOB-22</td>
<td>Digital connection card (115V)</td>
<td>Used in TSU.</td>
</tr>
<tr>
<td>SDCS-IOB-23</td>
<td>Digital connection card (230V)</td>
<td>Used in TSU.</td>
</tr>
</tbody>
</table>
### Terms

<table>
<thead>
<tr>
<th>Terms</th>
<th>Full Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDCS-IOE-2</td>
<td>UC-measurement board</td>
<td>Used in TSU.</td>
</tr>
<tr>
<td>SDCS-PIN-41</td>
<td>Pulse transformer board</td>
<td>Used in TSU.</td>
</tr>
<tr>
<td>SDCS-PIN-51</td>
<td>Measurement board</td>
<td>Used in TSU.</td>
</tr>
<tr>
<td>SDCS-POW-1</td>
<td>Power supply board</td>
<td>Used in TSU.</td>
</tr>
<tr>
<td>SW</td>
<td>Software</td>
<td>Computer programs.</td>
</tr>
<tr>
<td>TSU</td>
<td>Thyristor Supply Unit</td>
<td>Full controlled thyristor input bridge.</td>
</tr>
<tr>
<td>UART</td>
<td>Universal Asynchronous Receiver Transmitter</td>
<td>Communication controlled circuit used in asynchronous communication protocols.</td>
</tr>
<tr>
<td>UPS</td>
<td>Uninterrupted Power Supply</td>
<td>Power supply equipment with battery to maintain output voltage during power failure.</td>
</tr>
<tr>
<td>UR fuse</td>
<td>Ultra Rapid fuse</td>
<td>Fuse type used to protect semiconductors.</td>
</tr>
<tr>
<td>VSD</td>
<td>Variable Speed Drives</td>
<td>Speed controlled electrical motor.</td>
</tr>
<tr>
<td>XT</td>
<td>Extension</td>
<td>R&amp;E project name. It stands for power range extension of ACS 600 product family by paralleling inverter modules.</td>
</tr>
<tr>
<td>YPQ112A/B</td>
<td>DDCS Interface board for CDC system</td>
<td></td>
</tr>
</tbody>
</table>