ABB INDUSTRIAL DRIVES

ACS580MV Commissioning Manual
(200kW to 6300 kW, 3.3kV to 11 kV)
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<td></td>
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When third-party equipment is included in the scope of commissioning see also:

- Main circuit breaker manual
- Protection relay manual
- Motor manual
- Electrical drawing of Bypass unit

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This document has been checked with due care and attention. However, should the user find any errors, these should be reported to ABB.

ABB aims to maintain the most modern standard; therefore, entries in this manual may differ from the actual product.

You can find manuals and other product documents in PDF format on the Internet. See http://www.abb.com/motors&drives. For manuals not available in the Document library, contact your local ABB representative.

For more information, please refer to ACS580MV Hardware Manual which can be found by scanning the QR code below.
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## Terms and trademarks

### Terms

The following table lists the terms and abbreviations you should be familiar with when using the manual. Some of the terms and abbreviations used in the manual are unique to ABB and might differ from the normal usage.

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<tr>
<th>Term / Abbreviation</th>
<th>Meaning</th>
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<tr>
<td>BCU</td>
<td>Control unit used for controlling drives, inverters and converters via fiber optic links.</td>
</tr>
<tr>
<td>Converter</td>
<td>Short form for ACS580MV frequency converter.</td>
</tr>
<tr>
<td>COU</td>
<td>Control unit Short form for control compartment of the drive.</td>
</tr>
<tr>
<td>DDCS</td>
<td>Distributed Drive Control System DDCS is an acronym for a serial communication protocol designed for data transfer via optical fibers.</td>
</tr>
<tr>
<td>Drive</td>
<td>Short form for ACS580MV frequency converter.</td>
</tr>
<tr>
<td>Drive system</td>
<td>The drive system includes all equipment used to convert electrical into mechanical power to give motion to the machine.</td>
</tr>
<tr>
<td>DriveStartup</td>
<td>DriveStartup guides step by step through the complete commissioning including reporting.</td>
</tr>
<tr>
<td>Equipment</td>
<td>Frequency converter and related equipment.</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic compatibility All measures to suppress electromagnetic disturbances caused by different electrical equipment in the same electromagnetic environment, and to strengthen the immunity of the equipment to such disturbances.</td>
</tr>
<tr>
<td>ESD</td>
<td>Electrostatic discharge</td>
</tr>
<tr>
<td>Ground</td>
<td>Earth</td>
</tr>
<tr>
<td>To ground</td>
<td>The conducting path (e.g. conductor) between the electric equipment (e.g. frequency converter) and the earth. The electric equipment is connected to the earth, e.g. by a grounding set or a grounding switch.</td>
</tr>
<tr>
<td>INU</td>
<td>Inverter Unit The INU converts the DC voltage to the required AC motor voltage and frequency.</td>
</tr>
<tr>
<td>IGBT</td>
<td>Insulated Gate Bipolar Transistor</td>
</tr>
<tr>
<td>Line voltage</td>
<td>RMS voltage of the main power supply of the drive.</td>
</tr>
<tr>
<td>MCB</td>
<td>Main Circuit Breaker The MCB is a major protection device of the drive system and connects / disconnects the main power supply to the drive. The MCB is controlled entirely by the drive.</td>
</tr>
<tr>
<td>PCB</td>
<td>Printed Circuit Board</td>
</tr>
</tbody>
</table>
Trademarks

Names that are believed to be trademarks of other companies and organizations are designated as such. The absence or presence of such a designation should however not be regarded as an offence of the legal status of any trademark. The following registrations and trademarks are used in this manual:

<table>
<thead>
<tr>
<th>Term / Abbreviation</th>
<th>Meaning</th>
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</thead>
<tbody>
<tr>
<td>Windows®</td>
<td>Registered trademark of Microsoft Corporation</td>
</tr>
<tr>
<td>Ethernet®</td>
<td>Registered trademark of Xerox Corporation</td>
</tr>
<tr>
<td>Profibus®</td>
<td>Registered trademark of Profibus International (P.I.)</td>
</tr>
<tr>
<td>Modbus®</td>
<td>Registered trademark of the Modbus IDA organization</td>
</tr>
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<table>
<thead>
<tr>
<th>Term / Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCC</td>
<td>Point of Common Coupling. The PCC is the point in the electrical power supply system where the responsibility of the utility changes to the industrial customer. The utility is responsible to provide clean voltage and current with respect to harmonic distortion up to the PCC. The industrial customer is responsible not to distort voltage and current by its electrical systems.</td>
</tr>
<tr>
<td>PE</td>
<td>Protective Earth</td>
</tr>
<tr>
<td>PEBB</td>
<td>Power Electronic Building Block (semiconductor stack). This is another term for power module.</td>
</tr>
<tr>
<td>Power module</td>
<td>The power module is a compact assembly of electronic components including power semiconductors and circuit boards that serves as a standardized building block for the INU of the drive.</td>
</tr>
<tr>
<td>Safeline</td>
<td>ABB synonym for uninterruptible power supply.</td>
</tr>
<tr>
<td>TEU</td>
<td>Terminal Unit</td>
</tr>
<tr>
<td></td>
<td>Short form for terminal compartment of the drive.</td>
</tr>
<tr>
<td>TRU</td>
<td>Transformer unit</td>
</tr>
<tr>
<td></td>
<td>Short form for transformer compartment of the drive.</td>
</tr>
</tbody>
</table>
Safety instructions

Contents of this chapter

This chapter contains the safety instructions which you must obey when you install, commission and operate the drive and do maintenance on the drive. If you ignore the safety instructions, injury, death or damage can occur.

Safety instructions are used to highlight a potential hazard when working on the equipment. Safety instructions must be strictly followed! Non-compliance can jeopardize the safety of personnel, the equipment and the environment.

### DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

### WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

### CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

DANGER Working on energized equipment can be a life hazard. Mechanical forces, electric shock and burn can cause severe injuries or death. Safety related work practices must be followed at all times. Take appropriate measures when working on the drive system. Before power is applied to the converter, it must be checked that all covers are back in place so that the voltage carrying parts cannot accidentally be touched. Interlocks, which prevent access to medium and high voltage, must be in operation.
• Protection covers inside the converter must be refitted. If covers have to be removed for measuring purposes, appropriate safety signs and temporary barriers must be installed and the personnel involved in the commissioning must be informed.

• Cabinet door locks must be checked. The manual release of the solenoid interlocks must be in the locked position. See also ACS580MV Hardware Manual (2UBB004520).

• The doors should be kept closed whenever possible. This also helps to keep the cabinets clean.

• The door keys should only be given to the personnel who take part in the commissioning.

• All openings of the motor must be closed and the shaft covers must be installed.

• The area around the motor must be cordoned off to prevent accidents during the uncoupled motor tests.

• All covers of power cable terminals or terminal boxes in converter, motor, transformers and MCB must be closed.

• More details please refer to Safety instructions in ACS580MV Hardware Manual (2UBB004520).

**NOTICE** Because there is no ground switch inside the cabinet, regarding to check the power module, make sure to follow the safety rule described in Maintenance of ACS580MV Hardware Manual (2UBB004520). Local safety regulations must be also observed to maintain safety. For 13.8kV input voltage, PPE and Safety should follow “ABB Electrical Safety Matrix” (SA-S-101-07-01) and be defined by each country’s HSE department.
Introduction to the manual

Contents of this chapter

The purpose of the manual is to assist in commissioning the ACS580MV frequency converter. It includes necessary instructions, practical hints and references to related documentation to successfully commission the converter and the related equipment as needed for the application.

**NOTICE** Commissioning of the converter may only be carried out by personnel who have been certified with “Basic” or above training level.

Scope of commissioning

Normally, the commissioning engineer is only responsible for the converter. If agreed by contract, the commissioning engineer who have gained the related certification can take on the commissioning of:

- Motor
- MCB / protection relays
- Manual / Sync Bypass unit, (MSS, MB)

Requirement for reports

During the commissioning the Field Service Report and Commissioning Report should be prepared, which are generated by the DriveStartup tool.

Service engineer shall upload the commissioning report within one month after commissioning, or upload the service report within one week after the service.
MV Drives Supportline contact

Before starting the commissioning, please contact ABB Drives Supportline to get the license key:

**Email address:** drivessupport@abb.com

**Queue in Salesforce:** GLO-MO/Global Drive support

Exception / different contacts for large countries:

- China: mv.drives.supportline@cn.abb.com/CN-MOSE/4159/MV Drives Support
- India: mv.drives.supportline@in.abb.com/IN-MOSE/Drives
- USA: us-drivessupport@abb.com/US-MO/Drives/Tech Support/MV
Standard Commissioning Process

Pre-Commissioning check lists

Contents of this chapter
This chapter provides information on pre-commissioning check lists.

Office preparation check list
In order to achieve an efficient commissioning, make sure that the following items are completed before traveling to site:

- Field service report template
- Programing software tools and DriveStartup software tool
- Copies of converter documentation (commissioning manual, wiring diagrams, mechanical drawings and publications as per List of related manuals)
- Information on the scope of delivery
- Information on latest SW and parameter updates (contact MV Drives Supportline)
- Information on possible converter upgrades
- Setting values for motor parameters
- Commissioning program (to be agreed with customer)
- Suitable megger for insulation test if necessary
• License for the drive
• Digital camera or mobile phone for taking photo

## Required tools

The tools list is shown as below, for reference:

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<th>No</th>
<th>Name</th>
<th>Pictures</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
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<td>1</td>
<td>USB transfer Mini USB cable (3M) [Code: 3ABD00036680]</td>
<td><img src="image1.png" alt="USB cable" /></td>
<td>Communication cable, between PC and control panel</td>
</tr>
<tr>
<td>2</td>
<td>MC502 (SD memory card) [Code: 3ABD10058698]</td>
<td><img src="image2.png" alt="MC502" /></td>
<td>I/O controller programming tool</td>
</tr>
<tr>
<td></td>
<td>MC503 (SD card adaptor) [Code: 3AFE10094795]</td>
<td><img src="image3.png" alt="MC503" /></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>USB XILINX HW-USB-II-G (Model:DLC10) [Code: 3ABD00034510]</td>
<td><img src="image4.png" alt="USB XILINX" /></td>
<td>Control Hub programming tool</td>
</tr>
<tr>
<td>4</td>
<td>USB-5V power cable [Code:2UBA011603R0001]</td>
<td><img src="image5.png" alt="USB-5V cable" /></td>
<td>External power supply for power module</td>
</tr>
<tr>
<td>5</td>
<td>Multi-Contact GRIP-CI [Code: 3ABD00051018]</td>
<td><img src="image6.png" alt="Multi-Contact GRIP-CI" /></td>
<td>4mm Safety Test Clip CRIP-CI; 1000V, CAT III/16A</td>
</tr>
<tr>
<td>No</td>
<td>Name</td>
<td>Pictures</td>
<td>Descriptions</td>
</tr>
<tr>
<td>----</td>
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<td>---------------------------------------------</td>
</tr>
<tr>
<td>6</td>
<td>Multi meter</td>
<td><img src="image" alt="Multi meter" /></td>
<td>Such as FLUKE 179</td>
</tr>
<tr>
<td>7</td>
<td>Safety Lockout</td>
<td><img src="image" alt="Safety Lockout" /></td>
<td>PPE</td>
</tr>
<tr>
<td>8</td>
<td>General tools, including nut driver, screw driver and torque wrench, etc.</td>
<td><img src="image" alt="General tools" /></td>
<td>10 - 75 Nm for hexagon head screws M6 to M12</td>
</tr>
<tr>
<td>9</td>
<td>Insulation Tester</td>
<td><img src="image" alt="Insulation Tester" /></td>
<td>Such as KYORITSU KEW3122A</td>
</tr>
<tr>
<td>10</td>
<td>General personal PPE</td>
<td><img src="image" alt="General personal PPE" /></td>
<td>safe helmet, work clothes, insulated shoes, gloves, earplug, glasses, Prevent Static suit, etc.</td>
</tr>
</tbody>
</table>
18  Standard Commissioning Process

Scope of delivery

After receiving the converter and related equipment, the customer is asked to check all items against the bill of material and shipping damages. Missing parts should then have been reported immediately to the carrier and the project responsible ABB organization. All claims for damage should have been made to the carrier and ABB should have been notified.

To avoid unnecessary delay of the commissioning, the commissioning engineer must assure himself that the equipment is complete and intact. Should parts be damaged or missing the carrier or ABB must be contacted.

It is recommended practice to photograph damaged equipment and send the photographs to ABB and the carrier.

Checking the pre-conditions for commissioning

In order to ensure uncomplicated and efficient commissioning, it is important that converter and associated equipment are ready for commissioning. The mechanical and electrical installation should be done as described in the ACS580MV Hardware Manual (2UBB004520). Reviewing and completing the items in the below list before the commissioning engineer arrives on site will help achieve this.

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<tr>
<th>No</th>
<th>Name</th>
<th>Pictures</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
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<td>11</td>
<td>FLUKE F80K-15 [Code: 3ABD00042166]</td>
<td><img src="image" alt="FLUKE Electronic probe" /></td>
<td>FLUKE Electronic probe. Refer to ACS580MV Hardware Manual (2UBB004520)</td>
</tr>
<tr>
<td>12</td>
<td>USB to POF cable [Code:2UBA011603R0002]</td>
<td><img src="image" alt="USB to POF cable" /></td>
<td>PEBB FW download tool</td>
</tr>
<tr>
<td>13</td>
<td>Ethernet cable, 2.2M FTP [Code:2UBA010631R0001]</td>
<td><img src="image" alt="Ethernet cable" /></td>
<td>Communication cable, between PC and Marshalling PLC.</td>
</tr>
</tbody>
</table>
Mechanical installation of converter

- Converter is securely fixed to the floor.
- INU cabinet and TRU cabinet have finished combination.
- Converter doors must open and close easily.
- The floor that the unit is installed on is of non-flammable material, as smooth as possible, and strong enough to support the weight of the unit. Check the floor flatness with a spirit level. The maximum allowed deviation from the surface level is 5 mm in every 3 meters. Level the installation site, if necessary, as the cabinet is not equipped with adjustable feet.
- Roof-mounted fan units are installed.
- Installation and damaged components. When inspecting the converter, attention must be paid to bad affixed, loosed or damaged components.

Electrical installation of converter

- Foreign parts, dust and moisture should not be present in the converter cabinets.
- Insulation or voltage test of cables, MCB, and motor have been done according to the manufacture specifications. An official test report must be available.

Control cable section:

- Types and cross sections of control cables are suitable for the signal type and signal level. The shield of analog cable need grounding properly.
- Control cables are connected. Customer interface is available in document.
  - MCB control cables are connected directly to the converter.
  - The wirings of remote control cabling are completed.
  - Cabling of options (transformer / motor protection, tachometer etc.) are completed.
  - For MBU configuration, forbid customer to set common point for open status, close status and ready status!

Power cable and grounding section:

- Grounding cables of MCB, converter and motor are connected and tighten. The cross section of the ground cable must be bigger than 150 mm².
- Types and cross sections of power cables are selected according to the ACS580MV Engineering Guideline (2UBB013672).
- All cable screens and equipotential bonding conductor are connected. The cross section of conductor cable should be bigger than 50 mm² for motor cable length less than 300 m, and bigger than 95 mm² for motor cable length bigger than 300 m.
- MCB and motor cables are not fastened at both ends (cables and converter must be pass the insulation test before connection).
- All cables between TRU and INU should be connected. For bolts types and torque requirement, see below table:
The connection to system ground has to be established in compliance with local regulations.

**Main circuit breaker (MCB)**

- The type of MCB is selected as per *[ACS580MV Engineering Guideline](#)* (2UBB013672).
- The MCB is ready to be tested with the converter.
- The MCB protection relay settings are set and tested, and it can be modified by requirement of commissioning engineer.
- Safety devices (door locks etc.) are tested and in operation.
- Local operation of MCB is disabled, and the connection to switch or button is canceled.
- The wiring of the control & signal cables connecting with the converter is finished.
- The user manual and technical specification is available.
- Withstand voltage test of the MCB have been done according to manufacture specifications. The official test report must be available.

### Bolt size | Bolt type | Tightening torque (Nm)
--- | --- | ---
M3 | Copper | 0.8
M4 | Steel/ Stainless steel | 2
| Copper | 1.2
M5 | Steel/ Stainless steel | 3
| Copper | 2
M6 | Steel/ Stainless steel | 5.5
| Copper | 3
M8 | Steel/ Stainless steel | 10 (aluminum busbar)/ 15(copper busbar)
| Copper | 6
M10 | Steel/ Stainless steel | 20 (aluminum busbar)/ 30(copper busbar)
| Copper | 10
M12 | Steel/ Stainless steel | 30 (aluminum busbar)/ 40(copper busbar)
| Copper | 15.5
M16 | Steel/ Stainless steel | 90 (aluminum busbar)/ 120(copper busbar)
| Copper | 30
M20 | Steel/ Stainless steel | 120 (aluminum busbar)/ 160(copper busbar)
| Copper | 52
Converter integrated transformer

- Transformer is in good condition after transportation.
- The primary tap is at the same level (-5% / 0% / +5%) if this option is available. If the network voltage is at the correct level of converter requires, just 0% tap of 3 phase need to be shorted. The tap level should be shorted based on the actual network voltage to match the converter requires.
- The PT100 inside the transformer is in good condition.

Power modules

The DC link capacitors need to be reformed (re-aged) if the converter power module has been nonoperational for more than one year. Without reforming, capacitors may get damaged when the power module starts to operate.

- Check the power module age. Serial number of power module defines the week when it was manufactured. For example, 2UBA916040009:
  - 16: denotes manufacturing year (2016).
  - 04: manufacturing week.
  - 0009: running manufacturing number.
- Regarding the instruction of reforming, refer to the documentation: ACS580MV PM Capacitor Reforming Instructions (2UBB017371).

BCON board

Provide below information, ask for the license from MV Drives Supportline:

- Series number of the drive
- Series number of the BCON board, including the board as spare parts.

Note: The position of BCON series number is shown hereunders.
Motor

- Motor is installed, aligned and alignment protocol is available.
- Motor is not coupled to the driven load.
- Grounding is completed in compliance with local regulation.
- Motor auxiliaries (bearing lubrication, heater cooling etc.) are ready.
- Control and monitoring signals are connected. If this option is available.
- Customer side motor protection set and ready. (e.g. winding temperature, vibration)
- The user manual and technical specification is available.
- Insulation of the motor has been tested according to manufacturing specifications. The official test report must be available.

Power

- Medium voltage is available for start-up of the converter.
- Low voltage auxiliary power is available for start-up of the converter.
- Low voltage space heater power is available. If this option is available.

Miscellaneous

- Sufficient number and correct type of spare parts are available.
- Desk and chair used for commissioning is available. Office power terminal is available.
- The infrastructure of the electric room is finished and the installation site is sufficiently ventilated or cooled and dehumidification to ensure the converter can running at the appropriate temperature and humidity.
- If operation with open doors filter of the room is available. It is not allowed to operate with open door or windows of the electrical room if air is not filtered.
- Air conditioning or ventilating duct of the drive room is ready for load run of the converter. Regarding last two options, window of electrical room should be with filter.
  - Air condition
  - Nature air cooling
  - Ventilating duct

Inspection of installation

In order to achieve a trouble-free commissioning, it is mandatory that the installation, including third-party equipment, is inspected upon arrival.

The status of the installation is checked and it is verified that converter and related equipment meet the applications specification. It should be verified that the installation is done according to the installation instructions and the applicable safety regulations have been met.

Check the installation with the guidance of the DriveStartup tool and the above Pre-Commissioning Check Lists in Checking the pre-conditions for commissioning. Information about installed equipment which is required by the report must be obtained and noted in the corresponding sections of the report.
If further information on the equipment is required, the applicable manufacturing documentation should be consulted.

**Converter room**

When inspecting the converter room, attention must be paid to the following:

- Civil works must be finished in the converter room.
- The converter room must be clean (free of dust) and dry.
- Air filters of the electrical room if which is open must be in place.
- Air conditioning or ventilating duct must be available, latest when the converter will be operated continuously.
- The wall behind the unit is of non-flammable material.
- There is enough free space to the drive to enable cooling air flow, service and maintenance.
- The floor that the unit is installed on is of non-flammable material, as smooth as possible, and strong enough to support the weight of the unit. Check the floor flatness with a spirit level. The maximum allowed deviation from the surface level is 5 mm in every 3 meters. Level the installation site, if necessary, as the cabinet is not equipped with adjustable feet.

If the condition of the converter room hampers effective commissioning, the customer and the responsible ABB project engineer must be informed immediately.

Cleanliness of the converter room should be checked several times during commissioning.

**Converter**

The inspection includes the mechanical and electrical installation of the converter. By visually checking the converter, the commissioning engineer obtains an overview of the condition of the converter and can react in time if corrections have to be made.

Useful information about the requirements for the installation site is described in the *ACS580MV Hardware Manual* (2U8B004520).

If the installation of the converter has not been carried out as required or the condition of the converter hampers effective commissioning, the customer and the responsible ABB project engineer must be informed immediately.

When inspecting the converter, the Pre-Commissioning Check Lists in *Checking the pre-conditions for commissioning* can be used. Depending on the configuration of the converter and engineered options, there might be less or more check items. Always see supplied parts list, mechanical and electrical drawings for reference.

**Motor**

The motor area must be clean so that it is safe to run the motor. All waste that can come in contact with the shaft or the cooling air inlets must be removed.

The motor installation includes the lubrication piping, piping for the water cooling system and the alignment of the motor. An alignment protocol must be available on site.

The motor frame must be connected to the plant’s ground network at least at one point. For more details see instructions of the motor manufacturer.

Motor bearing sleeves shall be insulated from the motor frame.
Commissioning third-party equipments

If third party equipment has to be commissioned by an ABB commissioning engineer, the scope of the work involved and the responsibilities must be agreed by contract and the commissioning engineer must be informed accordingly.

If the equipment mentioned in the following sections is not commissioned by an ABB commissioning engineer, confirmation that the equipment has been tested and is ready for operation must be obtained from the responsible person.

In DriveStartup: It is necessary that the steps are reviewed when checking third-party equipment and that each item is checked off before the commissioning has been completed.

Main circuit breaker (MCB)

The main circuit breaker is commissioned and the insulation tests are performed according to the manufacturer’s documentation.

The signed MCB commissioning report must be received from the responsible person.

The correct operation of the MCB will be tested before the MCB is used to supply the main power to the converter. The test is performed with the MCB in test position.

Information on the required control interface to the converter and on the breaking time of the circuit breaker can be obtained from the ACS580MV Engineering Guideline (2UBB013672) and the converter wiring diagrams.

The following has to be checked:

- It is forbidden to set common point for open status, close status and ready status signals.
- The MCB must open once the auxiliary power is removed. If the MCB is equipped with under voltage trip coil.
- The MCB is commissioned and the insulation tests are performed according to the documentation of the manufacturer (The signed MCB commissioning report must be received from the responsible person).

Power cables

The insulation resistance must be measured or the confirmation of the measurement must be obtained.

In case measurement has to be performed by the service engineer, please refer to Power Cables Insulation Test.

**NOTICE** The field engineer should confirm that the power cables are connected to the correct bus bars before switching on the main power. Once the main power direct reach the output bus bars by wrong connections, the power modules would be irreversible damaged.
The following has to be checked:

- Check the main cables are well installed according to the *ACS580MV Hardware Manual* (2UBB004520).

- Measure the resistance of the output busbars by multimeter. The typical values would be several ohms based on the motor data if the motor is connected.

- Measure the resistance of the input busbars by multimeter. The typical values would be several ohms if the TRU is connected and the MCB is not grounded, then ground the MCB, the values would be changed to nearly zero ohm.
Terminal compartment, original view from front

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Voltage dividers</td>
</tr>
<tr>
<td>2</td>
<td>Motor side terminals</td>
</tr>
<tr>
<td>3</td>
<td>Input terminals</td>
</tr>
<tr>
<td>4</td>
<td>Cable entry plate</td>
</tr>
<tr>
<td>5</td>
<td>Cabinet grounding busbar</td>
</tr>
</tbody>
</table>
Protection relays

ACS580MV with integrated transformer

The protection relays in the feeding switchgear for the converter's transformer must be commissioned and tested as per the manufacturer’s documentation.

The settings for the protection relay are defined by the protection or system engineer. The commissioning engineer should only verify these values.

Relay test protocols must be available on site before the drive is energized.

**NOTICE** The below mentioned settings are just informative for the commissioning engineer, in which range the protection settings should be made. The customer is fully responsible for the protection settings.

A protection curve can be programmed into the relay. The protection curve defines how long a current of a certain magnitude is allowed to flow until the relay opens the MCB. There are three types of protection modes:

- Instantaneous
- Short delay
- Time over current protection

The recommend protection functions and setting values:

<table>
<thead>
<tr>
<th>Protection functions</th>
<th>Setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate overcurrent trip level</td>
<td>10 times the rated current of the ACS580MV</td>
</tr>
<tr>
<td>Short time delay overcurrent trip level</td>
<td>2 times the cable rated current with 500ms delay</td>
</tr>
<tr>
<td>Long time delay protection pickup level</td>
<td>1.3 times the rated input current of the ACS580MV</td>
</tr>
</tbody>
</table>
Motor

All checks and insulation measurements of the motor and its auxiliary systems must be performed according to the instructions of the motor manufacturer.

Checking of the motor includes the following:

- Insulation resistance. The insulation resistance must be measured or confirmation of the measurement must be obtained. In case measurement has to be performed by the service engineer, please refer to Motor Insulation Test.

- Oil quantity of lubrication unit.

- Visual check of electrical and pneumatic instrumentation.

- All electrical instruments, pumps and electrically controlled valves are shown in the circuit diagram of the motor auxiliaries. Operation of these devices will be checked when the external control signals are tested, see Cold commissioning.

- Temperature measurement of windings and bearings.

- Vibration sensors.

Insulation Resistance Measurements

Before any of the components in the drive system can be energized, it must be assured that they are able to withstand the voltage stress. This can be verified by measuring the insulation resistance. If the measured insulation resistance value of the motor, transformer or converter is too low, the reason may be that insulators, windings etc. have moisture in them and it may be necessary to dry the windings.

It is advisable to compare the test results with the test reports from the supply factories.

The contractor or customer can make the insulation resistance measurements on the supply cables and motor, in that case a signed test-protocol of all measurements must be attached to the commissioning report.

Preparations

Make sure that the Main Circuit Breaker is racked out.

Disconnect the cables between the converter and the motor and isolate them from ground and the frames of the converter and the motor.

External MCB Insulation Test

The MCB is commissioned and the insulation tests are performed according to the documentation of the manufacturer (The signed MCB commissioning report must be received from the responsible personnel or company).
Converter Insulation Test

NOTICE Drive insulation test is not mandatory, it shall be applied or recommended only if:

- Long storage time of the drive (such as >6 months).
- Humid environment (Respectively humid storage condition).
- Visual inspection shows any transportation/installation damages.
- Always on customer request.

Required tools and accessories

- 5 mm hex-head key
- Multi meter
- Test leads for short-circuiting the terminals
- 5 kV insulation tester (megger)

Procedure

Note: The terminals and components referred to in the following section correspond to those in the Figure Overview of high voltage part short circuit wiring.

1. Switch off the main and auxiliary power supply and ground the equipment.
2. Switch off all the breakers and fuses in the Control unit.
3. Disconnect +24V power supply plug of all control board (BCON, CVMI2, IO controller, Control hub, etc.).
4. Disconnect the arresters from the input bus bars.
5. Disconnect HVR boards from medium voltage side.
6. Short-circuit all inputs, outputs bus bars, and connect them to each other.
7. Short-circuit all the PMs three phase inputs, outputs and housings, connect them to the high voltage circuit.
8. Short-circuit all isolation switches QS1(Q1), QS2(Q2) and QS3(Q3) of Manual bypass cabinet (if MBU=0001).
9. Short-circuit all contactors KM1(Q1), KM2(Q2) and KM3(Q3) of Auto bypass cabinet (if MBU=0002 or MBU=0003).
10. Short -X107:1,2; -X108:1,2. Note terminal 2 was grounded already (if SBU=0001 & SBP=0001).
11. Switch off PT power supply from customer side, disconnect PT (-X107:1,2,PE; -X108:1,2,PE; -X109:1,2,PE if available), if SBU=0001 & SBP=0000.
12. Perform the insulation test between the main circuit and ground.

- Test voltage: 5 kV for 60 seconds
- Duration: 60 seconds
- The insulation resistance value must >500MΩ in below test condition:
  a. Ambient temperature in the range of 0 °C to 40 °C
  b. Relative Humidity <70%
13. Reverse all disconnections and remove the short circuit wires.

**NOTICE** A short-circuit in any part of the drive will lead to severe damage. Therefore, check that all short-circuit leads have been removed before energizing the drive.

---

**Overview of high voltage part short circuit wiring**

You can also measure the insulation resistance of the transformer separately from the drive. Please see *Preventive Maintenance*.

- **Motor Insulation Test**

  The frame and the windings not being tested must be grounded during the insulation resistance measurement.

  All resistance temperature detectors (RTD) must be grounded.

  The insulation resistance of a new motor is normally very high. A rule of a thumb can be that if the measured value is one decade or more lower than the value measured in the factory, check the winding for excess moisture or dirt. The test report contains the insulation resistance value measured in the factory.
• If the motor star point is reachable, measure each phase separately as shown below.

*Insulation resistance measuring when star point is reachable (3 measuring values)*

• If the star point is not reachable, measure all phases together as shown below.

*Insulation resistance measuring when star point is not reachable (1 measuring value)*

• If the reading is too low, dry the motor windings according to instructions in the motor documentation.

**Power Cables Insulation Test**

Measure the insulation resistance of all power cables and write down the measured results.

Measurements have to be made between all phases (all cables apart from each other) and between all cables and ground (all cables bound together at one end). Record the lowest value for each measurement.
Preparing the converter for start-up

- **Connecting the auxiliary supply**

  The ACS580MV uses different auxiliary voltage supplies.
  
  - 3 phase supply is needed for powering the cooling fans. According to option the power supply can also come from the integrated transformer.
  
  - The control section is powered by external single phase AC power supply.
  
  - Individual 1 phase AC power supply that feed to the optional section, such as cabinet heater, MBU/SBU/MAU control circuit.

  The main breakers of the auxiliary power supply are located in the control cabinet.

- **Check terminal X1 terminal before energizing auxiliary supply**

  In order to prevent device (such as BCON, AC500, etc.) from damaging by wrong wiring, new design of X1 terminal with pluggable connectors (Plug4P&5P) was introduced. The connectors are not allowed to be plugged into X1 until examination finished by service engineer as following procedures.

  1. Tear off the warning label after confirming it is intact.

  NOTICE For old X1 terminal, disconnect X1:20(W41501), 22(W41502), 26(W41503), DI0(W45002) and DI1(W45003) on PLC,F24V:5(W41501),X24V1:4(W41610) shown in below pictures. Make sure all pulled out wiring have well insulation.
2. Inform customer send MCB close/open status signal, and measure voltage as below table, the values should not be higher than 5V.

<table>
<thead>
<tr>
<th>Probe+</th>
<th>Probe-</th>
<th>AC</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1:20</td>
<td>PE</td>
<td>&lt; 5V</td>
<td>&lt; 5V</td>
</tr>
<tr>
<td>X1:22</td>
<td>PE</td>
<td>&lt; 5V</td>
<td>&lt; 5V</td>
</tr>
<tr>
<td>X1:24</td>
<td>PE</td>
<td>&lt; 5V</td>
<td>&lt; 5V</td>
</tr>
<tr>
<td>X1:26</td>
<td>PE</td>
<td>&lt; 5V</td>
<td>&lt; 5V</td>
</tr>
<tr>
<td>X1:28</td>
<td>PE</td>
<td>&lt; 5V</td>
<td>&lt; 5V</td>
</tr>
<tr>
<td>X1:30</td>
<td>PE</td>
<td>&lt; 5V</td>
<td>&lt; 5V</td>
</tr>
</tbody>
</table>

**PLC DI0 and DI1**

**F24V:5 and X24V1:4**

**MCB status drawing**
3. Inform customer send remote MCB close/open CMD, and measure voltage as below table. The values should not be higher than 5V.

<table>
<thead>
<tr>
<th>Probe+</th>
<th>Probe-</th>
<th>AC</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1:42</td>
<td>PE</td>
<td>&lt; 5V</td>
<td>&lt; 5V</td>
</tr>
<tr>
<td>X1:44</td>
<td>PE</td>
<td>&lt; 5V</td>
<td>&lt; 5V</td>
</tr>
<tr>
<td>X1:46</td>
<td>PE</td>
<td>&lt; 5V</td>
<td>&lt; 5V</td>
</tr>
<tr>
<td>X1:48</td>
<td>PE</td>
<td>&lt; 5V</td>
<td>&lt; 5V</td>
</tr>
<tr>
<td>X1:50</td>
<td>PE</td>
<td>&lt; 5V</td>
<td>&lt; 5V</td>
</tr>
<tr>
<td>X1:52</td>
<td>PE</td>
<td>&lt; 5V</td>
<td>&lt; 5V</td>
</tr>
</tbody>
</table>

Remote MB CMD drawing

- **Other checking items**

Before energizing the Auxiliary supply for the first time, proceed as follows:

1. Make sure that all auxiliary switches, optional circuit breakers and protection switches inside the drive have been switched off.
2. Before turning on the fuses and breakers, measure the incoming auxiliary voltage and control voltage, verifying that it is within +/- 10% of the rated value.
3. Confirm that the installation and wiring of the cooling fan is correct if the fan has been removed by customer. When the cooling fan needs removing for some reason, just pull off the left side plug.

4. If XDI interface on BCON is used, please disconnect XDI terminals and inform customer to send instruction accordingly to confirm there is no input voltage, otherwise X10, X90 can be damaged.

5. If XAI, XAO interfaces on BCON are used, please confirm input of XAI should be 0(2)-10V or 0(4)-20mA, higher input can damage BCON.
Note: 220V power supply and digital input and analog input should separate with each other, it’s not allowed to use common shield cable, and every cable’s shield must be reliably grounded.

6. Check the door interlocking system is working properly. If it is necessary, change the electrical lock from the release position to the lock position.

7. Check remaining control signals connected the converter and also the 3rd part equipment control signal are connected correctly and tighten. Observe the limited contact rating of the ACS580MV I/O relays. Use the interposing relays for higher current rated as a solution.

After checking above items, insert the plugs for X1 and BCON, and recover the wirings disconnected.

**WARNING** Control power supply is not allowed to switch on until these checking items is completed. Don’t insert plug4P&5P with power supply on!

### Loading software and prepare DriveStartup

#### Loading software to all the control boards

As preparation for software downloads take the loading packages for the latest software release and unzip the file in a separate folder on your computer.

Check the software or firmware version from the routing test report or from the parameters group, it is not demand to upgrade the boards which have the latest version installed.

**Required hardware tools and accessories**

- Personal computer with Windows 7 or Windows 10, 32 bit or 64 bit, and Office 2013 or above version installed.
- USB transfer Mini USB cable (3M)
- MC502 (SD memory card)
- MC503 (SD card adaptor)
- USB XILINX HW-USB-II-G (Model: DLC10)
- 5.5 VDC power, USB to POF cable

**Required software tools and loading package**

- The latest MHDRE loading package (available in Medium Voltage Drives Portal)
- The latest Field service report package 2.2 or newer (available in Medium Voltage Drives Portal)
- Drive loader 2.1 or newer (available in ABB intranet)
- XILINX lab tools 14.3 or newer (available in Medium Voltage Drives Portal)
- Drive composer pro 2.6 or newer (available in ABB website)
- DriveStartup (embedded in the Drive composer pro, activated by the commissioning registration code)
- Tera Term PC tool (option, available at field upgrade)
Verifying integrity of drive upgrade package

To verify integrity of software being downloaded, following additional steps are recommended. The purpose of integrity verification is to ensure that local copy of release zip file is consistent with zip file originally released by ABB.

- Get the software package from Medium Voltage Drives Portal (or other trusted source).
- Get the published hash value that belongs to this software package from Medium Voltage Drives Portal (or other trusted source). Such as:

<table>
<thead>
<tr>
<th>Name of loading package</th>
<th>SHA-512 checksum</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017- B_Rev1_MHDRE_2.03.057+MHD PU_1.04.0+MHDCI_3.07.50+ MHDAP_1.04.0.6_1.03.83+GPAX x_5.80+LXES_21.10.0.zip</td>
<td>3d 00 82 c1 69 56 5c 90 ad e3 34 ec 6f 6d 89 93 d4 cc 0f 72 10 a5 b8 57 17 9f b7 01 ee e8 6b b6 16 4a 0a a1 ee 40 15 5e ee 65 63</td>
</tr>
</tbody>
</table>

- Calculate the “SHA-512” hash value of the software package:
  a. Open windows command prompt by clicking Start button and typing “cmd” to windows search.
  b. Go to directory containing your local copy of release zip file
  c. Give following command to re-calculate SHA-512 checksum: `certutil -hashfile <releasezipfile> SHA512`

Note: This checksum is an example only.
- Compare calculated checksum to checksum obtained from Medium Voltage Drives Portal and proceed further in download procedure if checksums are matching.

**NOTICE** In order to save time in case of upgrading software, field service engineer shall first check software version differences for each parts (e.g. BCON, Control hub, IO controller, etc.). Only the software parts that are different, will need an upgrade, the rest can remain as it is.
Loading the BCON software

- Install the Drive_loader_2_3_setup tool (or new) to local PC.

- Connect PC to the assistant control panel (ACS-AP-W/S), through the USB to Mini USB cable. Switch on the control power supply.
• Start Drive loader 2 and select the file LP_FirmwareUpgrade.lp from the loading package (folder: \01_BCON SW).
Wait until the tool identifies the port and reads data from BCON. Click “Download” button and wait until the download finished successfully.
• Open Drive composer, click on System info to check version of MHDF A and MHDAP. Check if the date and time are correct, otherwise set time.

Loading the ACS-AP-W/S assistant panel firmware
• Remove the panel from the drive. Connect PC to the assistant control panel (ACS-AP-W or ACS-AP-S), through the USB to mini USB cable.
• Start DLoaderWin32.exe from the loading package. (folder: \05_ControlPanelFW)

• Press the button “Open”, select the *.dlp file in software package.
• Press the button “Load SW” and wait till update is finished.
Loading the control hub firmware

- Install the XILINX lab tools 14.7.

  Copy the files as below to local disk, unzip the first one.

  ![Xilinx files]

- Start the xsetup.exe to install the software tool.

  **Note:** Do not connect Xilinx cable to PC during the whole installation.
• In this step, should select Lab Tools – Standalone Installation.
• In this step, only select Install Cable Drivers. Till to finish successfully.

• Switch off the control power.

• Remove the daughter boards DB2 and DB3 to get access the X5 connector on control hub.

• Connect XILINX platform cable USB II to X5 connector on control hub.

• Switch on the control power.
• Run the PROG_MHDCH.bat batch file to program the control hub. (folder: \03_Controlhub FW)

Note: If the error information like below, it means that the location of the IMPACT program needs to be added to the system path.
Copy the IMPACT path from the properties of program. Such as 'C:\xilinx\14.7\LabTools\LabTools\bin\nt64\'.

Open the System variables by the path: Start -> Settings -> Control panel -> System and Security -> System -> Advanced system settings -> Environment variables. Add to the value of “Path” in system variables the location of IMPACT.exe as value.

This needs to be done only once.
Note: If the error information like below, please create a folder named temp in drive C.

- Waiting nearly 5 minutes, programming successfully finished. Press any key to exit.

- Turn off the control power.
- Remove the XILINX platform cable USB II.
- Restore all daughter boards on control hub.
Loading the CVMI2 firmware

- Install the XILINX lab tools 14.7. Refer to the previous step.
- Switch off the control power.
- Connect XILINX platform cable USB II to X1301 connector on CVMI2.
- Switch on the control power.
- Run PROG_LXES.bat batch file to program the CVMI2. (folder: \06_CVMI2 FW)

Note: If the error information like below, it means that the location of the IMPACT program needs to be added to the system path.
Copy the IMPACT path from the properties of program. Such as 'C:\xilinx\14.7\LabTools\LabTools\bin\nt64'.

Open the System variables by the path: Start -> Settings -> Control panel -> System and Security -> System -> Advanced system settings -> Environment variables. Add to the value of “Path” in system variables the location of IMPACT.exe as value.

This needs to be done only once.
Note: If the error information like below, please new a folder named temp in drive C.

```

Press any key to start the programming...
ERROR:IMPACT:342 - Open file error, file C:"temp\udd401a_fpgaxilinx_log.txt" may not exist

Programming not successful
A log file has been created on: C:\temp\udd401a_fpgaxilinx_log.txt"
Press any key to EXIT...
```

- Waiting nearly 25 seconds, programming successfully finished. Press any key to exit.
- Turn off the control power.
- Remove the XILINX platform cable USB II.

**Loading the IO controller (AC500eco) software**

- Save the following files and folders to the SD card (MC502) root folder. Files can be found in the loading package (folder \04_IOController SW).

<table>
<thead>
<tr>
<th>Name</th>
<th>Date modified</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>USERDATA</td>
<td>5/9/2015 8:08 PM</td>
<td>File folder</td>
</tr>
<tr>
<td>SDCARDJNI</td>
<td>3/5/2015 5:16 PM</td>
<td>Configuration sett...</td>
</tr>
</tbody>
</table>

Note: Only MC502 SD card can be used. This is not the same SD card which is plugged into the BCU.

- Switch off the control power.
- Install SD card adapter (MC503) into CPU PM55X.
- Insert SD memory card (MC502) into adapter MC503.
• Switch on the control power. Update operation starts. Observe the LEDs on PM55X:
  a. RUN LED flashing slowly = reading from SD memory card
  b. RUN LED flashing fast = programming in progress
  c. RUN LED permanent on, ERR LED off = SW download successfully
• Switch off the control power and remove SD card and the adapter. New SW is activated after IO controller AC500eco CPU is restarted.

Loading the DSP software manually to power modules

**NOTICE** Upgraded software to power modules can be automatic loaded while first close MCB. Manually loading shall be applied or recommend only if:
- Automatic loading doesn’t work properly.
- Always on MV Drives Support line request.

Loading the DSP software automatically to power modules
• After MCB has been closed and medium voltage introduced to the converter, power modules boot up.
• BCON controller checks the SW version on each PM.
• If the version on PMs is not the same as the SW defined version.
• BCON will initiate SW downloaded to PMs.
• Due to safety reason, during SW download MCB will be open (fault 607E “PM software update in process” is active).
• The fault cannot be reset until SW download finished (Indicated by message: 607F “PM SW update done”).
• Please operate the converter according to the description of “DriveStartup”.

Loading the DSP software manually to power modules
• Necessary tools: 5.5 VDC power, USB to POF cable and fiber cable.
• Install the Tera term programing tool, select the default components.

• Check and confirm the drive has been discharged and door lock is released.
• Open the INU door and then switch off the control power supply.
• Connect the POF link to power module and USB to PC.
• We can find USB Serial Port in Device manager by selection of Computer/Manage from desktop, such as COM12.

• Select serial port and set baud rate to 115200 from Properties.

• Open the programming tool Tera Term.

• Set the Serial Port to COM12 (Same serial port as last step).

• Open the workspace of Tera Term, select the Setup/Serial port…

• Set the Baud rate to 115200, others settings keep the default values.
• Connect the 5.5 VDC cable to power module X1 and PC.

**Note:** terminal DC+ is the one which close to the fiber terminal.

• The Tera Term will ask you whether to erase the flash.

**Note:** If no action in 5 seconds, we need reboot the board.
• Type e to erase the flash, once erasing done, step to Ready for application code transfer...

• Open the File/Send file..., select the PEBB1_CellController.bin from the software package (folder \02_PowerModule SW).

**Note:** Confirm the Binary is enabled.
• Click the OPEN button to start programming.

• Several seconds later the message is shown as below, “application is programmed”.

• Repeat the steps to program all the power modules.

• Disconnect the programming tools.
• Once all the power modules are energized, check the software version through the parameter group 07 and group 70/71/72.

**Commissioning software tools on PC**

With 2018-A software release, field engineers will be supposed to do commissioning with new PC tools, embedded version of DriveStartup that integrated into Drive composer pro. One could get the new PC tools through downloading Drive composer pro. The suggested Drive composer pro released is version 2.1 or newer.

To activate the embedded version of DriveStartup, one should register Drive composer pro by a special license. Please contact MV Drives Supportline for solution.

**Installation of Drive composer pro**

- Download the latest software package or upgrade one, such as 2.1 or new.

- Select the prefer path, start to install.
• Complete the installation, press Finish.
Open the Drive composer in offline mode. Enter registration code from menu: Help/Enter license code. Reboot the drive composer pro.

Open the DriveStartup tool from the Drive composer pro

- Start the registered Drive composer pro tool.
- Launch the DriveStartup from the menu: Tools/Launch DriveStartup. Confirm the Commissioning from Mode selection.
• DriveStartup launched. OPC server does not need to set again.

• Add the loading package from the menu: View/Package Manager.
• Open the file from the below location (folder\08_DriveStartup\ACS580MV)

• Add the template of Field service report also from the menu: View/Package Manager.
NOTICE In the display settings adjust view to be 100%. (DriveStartup, informs to do this during installation.) Check the display setting on PC: Control panel/Appearance and personalization/Display, use the default selection Smaller - 100%. The recommend resolution of display is at least 1366x768.

Cold commissioning by DriveStartup

- Create the new project

Create the new project. Start the commissioning.
• Fill in all necessary information.

**Note:** Must fill in the full type code in Drive configuration, such as:

ACS580MV-066-A04A-J5-010+ AUX0000+ AWL0000+ HAS0000+ ARC0000+ ASC0010+ COL0001+ EPC0021+ CCS0000+ CMC0000+ CEO0000+ CPR0004+ CSC0001+ CSV0003+ DMT0001+ SEO0000+ CIT0000+ EXT0000+ FAT0000+ FAD0002+ FWE0000+ FAB0000+ GDS0001+ HWS0000+ TRR0073+ LOD0011+ LCH0000+ PCE0041+ MCE0041+ MCC0000+ RMC0001+ EAT0000+ EWT0000+ MOF0120+ MST0000+ MHP0000+ TSM0000+ OCH0000+ OCA0000+ PAK0000+ CPF0002+ TRV0000+ SHT0000+ SPP0000+ SPF0050+ SMV0066+ CEP0012+ PCM0100+ WMT0001

The full type code can be copied from the project information in MoR by searching the series number. If necessary, contact MV Drives Supportline.
Site inspection step by step.

- Take photos and prepare the ACS580MV Drive and Site Condition Check List. Attached in the project folder once completed.
Connected equipment inspection

- Fill in all necessary information from the equipment report. Including protection relays, MCB, integrated transformer, motor and power cables.

Note: Check every item carefully.
Cold commissioning

All necessary inspection

- Inspection of converter installation.

- Check if the power cable connection on the secondary side of the integrated transformer is correct.

**NOTICE** The connection of power cable must be solid. It is not allowed to have any washer between two cable lugs. The tightening torque should follow *ACS580MV Hardware Manual* (2UJB004520).
• Drive insulation test is not mandatory.

Setting parameters and checking control signals

• Switch on the control and auxiliary power supply accordingly. Return to Drive composer, select Refresh in menu View, get into the online mode.

**Note:** Refresh and check the service access level once restarting the connection, enter again the service level passcode if needed.

• Check the SW or firmware version.

**Note:** ACS-AP-W/S version should be checked also (folder \05_ControlPanel FW)

• Set the license received from the MV Drives Supportline. The Par. 96.70 license state should be Time unlimited.

**NOTICE** Below information should be provided to MV Drives Supportline for license inquiry:

• series number of the drive

• series number of the BCON board

**Note:** The position of BCON series number is shown hereunder.
• Refer to the motor nameplate for the following settings. Whenever possible, enter the values exactly as shown on the motor nameplate.

• According to the requirement of customer and project side, set the parameters which are specific for the project:
  a. Operation mode, in parameter group 19.
c. Start/Stop mode, in parameter group 21.
d. Speed reference ramp, in parameter group 23.
e. Frequency reference chain, in parameter group 28.
f. Protection, in parameter group 34.

**Note:** Generally, the protection parameters need to be set as default, do not modify unless receive the permission from MV Drives Supportline.

- Motor thermal protection, if need (motor temperature, cable temperature, motor cooling fan), in parameter group 35.
- Energy efficiency, in parameter group 45.
- Monitoring and scaling, in parameter group 46.
- Internal fieldbus settings, in parameter group 54.

**Note:** Only save and set, active default setting IO controller.

- Local control disable, in parameter group 81.

**Note:** Including the logic test, refer to the DriveStartup.

- MCB available / MCB ON prevention / MCB external protection monitoring, in parameter group 82.

**Note:** Including the logic test, refer to the DriveStartup.

- For particular parameter description refer to the *ACS580MV Firmware Manual* (3BHS811381).
- Configure and test the IO signals, such as control supply monitoring and door interlock.

**Note:** Including the logic test, refer to the DriveStartup.

**MCB testing**

The Main circuit breaker (MCB) is the connection to medium voltage and plays a major role in all safety concepts of the drive. By that it has to be tested carefully.

**DANGER** For testing the MCB make sure the MCB is racked out into test position. These tests must be made without medium voltage connected.

- De-energize MCB, so during MCB test, main power will not be introduced to drive.
- Put MCB in remote control mode.
- According to the DriveStartup instruction, conduct all the steps below. Observe the MCB control and feedback signals in the graph.
  a. 11.01 DIO status bit0 – MCB trip command (-1)
  b. 11.01 DIO status bit1 – MCB status closed
  c. 87.10 AC500 CPU DI status bit2 – MCB OFF command (front door)
  d. 87.10 AC500 CPU DI status bit3 – MCB ON command (front door)
  e. 87.10 AC500 CPU DI status bit4 – MCB status open
  f. 87.13 AC500 CPU DO status bit0 – MCB ON command
  g. 87.13 AC500 CPU DO status bit1 – MCB OFF command (-1)
• Press emergency off button on front door, fault **AFEB Emergency OFF button pressed** is active. Release emergency off button, the fault should deactivated.

• Press ON button on front door, MCB should be closed. Press OFF button on front door, MCB should be opened.

• Press ON button on front door, MCB should be closed. Press emergency off button on front door, MCB should be opened and fault **AFEB Emergency OFF button pressed** is active. Release emergency off button, the fault should deactivated.

• Press ON button on front door, MCB should be closed. Wait more than 3 seconds, Fault E110 DC link charging timeout should activate, MCB trips.

• Zoom out the graph. Verify that the MCB control and feedback signals respond in the correct sequence.

• Save measurement in the project. Then attach plot to report.
• Measure the MCB open time roughly in graph by comparing the signals MCB OFF command (-1) and MCB status open.

Note: The MCB open time should less than 100ms.

Checking Bypass unit logic

The bypass unit is mainly used as a back-up for a drive failure (e.g. a trip) or drive maintenance. The motor is then switched to bypass mode.

The bypass unit can be manufactured by the 3rd supplier following the CS580MV Engineering Guideline (2UBB013672). ABB engineer should check the logic before connecting the drive to medium voltage.

According to the project specifications test the bypass unit functionality.

Make sure that all the below listed conditions are fulfilled (refer to the principle diagram below):

• If converter is discharged (S1 open) S3 cannot be closed.
• If S3 is closed, S2 cannot be closed.
• If two commands are given at the same time only one can be active.
• Transition from Converter to Bypass: S2 can be closed only if S3 is open.
• Transition from bypass to converter operation:
  a. S1 can be closed only after S2 has opened.
  b. S3 can be closed only after the drive is charged.
• Bypass command given while the drive is not charged:
  a. While S3 is closed it has no effect - S2 stays open.
  b. When S3 is open it is possible activate Bypass - S2 closes.
• Bypass command given while the drive is running is not possible - has no effect.
• S3 open command given while the drive is running - not possible - drive should be stopped first.

Checking connection to overriding system

Follow the application design, configure and active the connection between the drive and overriding system.
1. Check all the control cables have been assembled according the customer interface drawing.

2. Select the type of connection to overriding system in DriveStartup: Standard IOs, External module IOs or Fieldbus.

3. Check the configuration in below parameter settings:
   - Group 19 Operation mode
   - Group 20 Start/stop/direction
   - Group 22 Speed reference selection
   - Group 82 Charging/MB control
   - Group 10 Standard DI, RO
   - Group 12 Standard AI
   - Group 13 Standard AO
   - Group 14/15/16 I/O extension module 1/2/3
   - Group 51 FBA A settings
   - Group 52 FBA A data in
   - Group 53 FBA A data out
   - Group 82 Charging, MCB control

4. Set the parameters as required and check the signals are correct sent and received between the drive and overriding system.

**Hot commissioning by DriveStartup**

After completing the tasks in the previous chapters, the converter can be energized.

---

**DANGER** From this step MCB is in normal position and controlled only by ACS580MV. Medium voltage can be connected to the converter! Confirm safety area of motor is cleared and auxiliary equipment of motor is in operation.

---

**Close MCB and Load Power Module software**

After MCB has been closed and medium voltage introduced to the converter, power modules (PMs) boot up.

BCON controller checks the SW version to each PM.

If all PMs don’t have the same version or if the PM SW version is outdated BCON will initiate SW downloading to PMs.

Due to safety reasons, during SW update MCB will be open (fault 607E “PM software update in process” is active).

The fault cannot be reset until the SW update is finished (this is indicated by another fault message: 607F “PM SW update done”).

Please operate the converter according to the description of “DriveStartup”.

---

**Cooling and heating system testing**

- Check the configuration and feedback signals of the cooling fans. Group 87 Cooling system, parameter 17.5/87.40 INU/TRU fan feedback.
Note: Parameter 83.10 is not the actual number of fans, but the standard number of fans if redundant fan configured. Please refer to `2UBB005088_ACS580MV_3.3-11KV_Line-up_overview` for standard fan configuration.

ACS580MV standard fan configuration

- Test run the fan by setting the TEST RUN on parameter 83.12 Fan control. Check the fan's direction of rotation.
  a. For AC fan, if the direction is wrong, swap two phases of power supply and test again.
  b. For EC fan, which have been programmed and tested, contact MV Drives Supportline if unusual problem occurs.

- Measure the air pressure (parameter 1.35 INU air pressure), compare the value with the record in factory test report. If the deviation is bigger than +/- 50 Pa, do the following:
  a. Check the fan operation.
  b. Check the filter pads on the INU cabinet door.
  c. Check the pressure sensor.
  d. Check the air duct if present.
  e. Check the condition of the electrical room.
• Set the limitation in Parameter 83.32/34 INU air pressure low/high limit.

<table>
<thead>
<tr>
<th>Frame Size</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>R6</th>
<th>3.3/4.16kV R6</th>
<th>R7</th>
<th>R8</th>
<th>R9</th>
<th>3.3/4.16kV R9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Limit 83.32</td>
<td>100</td>
<td>100</td>
<td>150</td>
<td>100</td>
<td>100</td>
<td>200</td>
<td>150</td>
<td>100</td>
<td>200</td>
<td>200</td>
<td>150</td>
</tr>
<tr>
<td>High Limit 83.34</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
</tr>
</tbody>
</table>

• Check the below signals should be similar value to ambient temperature.
  a. 1.31 Ambient temperature
  b. 1.32 Trafo winding U1 temperature
  c. 1.33 Trafo winding V1 temperature
  d. 1.34 Trafo winding W1 temperature

• If space heater is installed parameter 81.20 Space heater control should be activated and test the function.

Motor first run

| NOTICE | Make sure you set all motor parameters and check the motor area. Nobody and nothing should be touching the shaft or the fan when you run the motor or even stand too close to it. |

• Connect the motor to drive. Let motor cooling, lubrication and protection system run if present.

• Take the drive to Local control by DriveStartup, select online mode.

Note: If can’t set the speed reference by DriveStartup during the operation, try to disconnect the USB cable in online mode and connect the cable again after the DriveStartup announce the communication disturbing.

• Press ON button on the front door, drive will be charged and fans will run.

• Observe the motor behavior in the graph below. Start the motor to a low speed reference (10% of nominal value) and check the rotation direction.

• Increase the speed reference by 10% until nominal speed is reached, then decrease the speed reference by 10% to 0.
• Observe and save the measurement, attach plot to report.

If the motor rotates in the opposite direction correct the motor cabling or change the parameter 99.16 Phase order to UWV.

**Fly start**

If flystart is required by the project, do the below test, otherwise skip this step.

• Take the drive to Local control by DriveStartup, select online mode. Save and set following parameters:
  a. 21.19 Scalar start mode to Automatic
  b. 21.03 Stop mode to Coast

• Set the speed reference to motor rated speed and start the motor. When motor reaches the set point stop it and restart nearly 10s later.

• Repeat the steps at different points as required, confirm the motor can be well found and controlled.

• Observe and save the measurement, attach plot to report.
In case of issues occurred in the above step, try to tune the parameters below. Refer to *ACS580MV Troubleshooting manual* (2UBB005092) for more information.

a. 21.02 Magnetization time  
b. 21.30 Flystart current level  
c. 21.31 Flystart flux ramp time  
d. 21.32 Flystart frequency min  
e. 21.33 Flystart frequency ramp time  
f. 21.34 Flystart reverse enable  
g. 21.35 Flystart speed detect curr level  
h. 21.37 Flystart Iq ctrl filt time  
i. 21.38 Flystart Iq ctrl Kp  
j. 21.39 Flystart Iq ctrl Ki

If Flystart doesn’t perform negative speed search.

When motor is stopped with some load and motor is rotating in the negative direction. Run the motor again with Automatic start mode (Par 21.19 scalar start mode = Automatic), speed scan is performed and small positive speed is found even though motor is rotating in negative direction. And then:

a. No negative speed scan.  
b. Flux reference is ramped assuming that the motor is rotating on the small positive speed.  
c. Motor cannot accelerate to the given reference. Motor stall warning is activated.  

The parameters can be tuned to achieve the correct behavior by:

a. Decrease the Par 21.35 Flystart speed detect curr level to 0.4 or lower (0.3 or 0.2).  
b. Decrease the Par 21.33 Flystart frequency ramp time.
Control from overriding system

Two external control locations EXT1 and EXT2 are available.

The user can select the sources of the MCB open and MCB close commands separately for each location by parameters 82.20 MCB Ext1 commands and 82.21 MCB Ext2 commands.

The user can select the sources of the start and stop commands separately for each location by parameters 20.01…20.10.

The operating mode can be selected separately for each location, which enables quick switching between different operating modes, for example speed and torque control. Selection between EXT1 and EXT2 is done via any binary source such as a digital input or fieldbus control word (see parameter 19.11 Ext1/Ext2 selection).

The source of reference is selectable for each operating mode separately. For speed reference setting go to parameter group 23 if Rpm is used, or parameter group 28 if Hz is used. For fieldbus setting, go to parameter group 50, 51, 52, 53.

NOTICE Don’t select the application macro by setting 96.04 Macro select, because it will reset some of parameters which had been changed to default value. Change corresponding parameters. Only FBA A is for use. FBA B is used internally for IO Controller in slot 2.

• Release the local control button on DriveStartup, only record the graph in this step.

• Check the parameters are correctly set regarding external control.
  a. The I/O terminals (digital and analog inputs), or optional I/O extension modules
  b. An optional fieldbus adapter module
  c. Other requirement.

• Control the drive by overriding system.

• Add additional signals to the graph if necessary.
• Observe and save the measurement, attach plot to report.

- Motor ramp up and down with load

**DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury. After the motor has been coupled and run with the driven equipment, all interlocks from an overriding control system must be in operation. These interlocks should stop the drive if a critical condition occurs in the process. If the trip levels, acceleration or deceleration times are set wrong it may cause mechanical damages on the application or interrupt the process.
• Motor speed ramp up
  a. Set the speed reference to motor rated speed in drive control toolbar.
  b. Start the motor and observe the related signals, compare the current with parameter 30.17 Maximum current.

• Motor speed ramp down
  a. Set the speed reference to 0 in drive control toolbar.
  b. Observe the related signals, compare the DC voltage with parameter 30.54 Overvoltage limit. Stop the motor.

• If above conditions are fulfilled the requirement, repeat both tests 3 times.

• If not fulfilled the requirement, check the below parameter setting.
  a. Parameter 21 Start/Stop mode
  b. Parameter 23 Speed reference chain
  c. Parameter 28 Frequency reference chain

• Observe and save the measurement, attach plot to report.

Run the motor for a while from customer control while you fill in the paperwork.

Vector Control

Before doing vector control related test, configure the drive as normal with scalar control mode according to normal service configuration process. Check that the drive can run the motor normally.

• Set control mode to vector. Parameter 99.04 for setting Motor control mode.

• Calculation of asynchronous motor parameters. For precise vector control performance, it is recommended to get motor 1-ph equivalent circuit diagram. Nameplate data could be used as a workaround.
### Calculation of Asynchronous Motor Parameters

**Notice:**
For precise vector control performance, motor 1-ph Equivalent Circuit diagram should be available. As a workaround, estimation of Motor Parameters using "Pole Data" could also be used for normal vector control.

Once below motor model parameters could not be offered by customer, use the ready-made Excel tools to estimate or calculate motor parameters.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_s$ (user)</td>
<td>0 [p.u.]</td>
</tr>
<tr>
<td>$R_r$ (user)</td>
<td>0 [p.u.]</td>
</tr>
<tr>
<td>$L_m$ (user)</td>
<td>0 [p.u.]</td>
</tr>
<tr>
<td>$\Sigma L_u$ (user)</td>
<td>0 [p.u.]</td>
</tr>
</tbody>
</table>

Excel tools for AD motor parameters calculation

### Rated Values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Nom Voltage</td>
<td>$V_{rat}$ 10,000 V</td>
</tr>
<tr>
<td>Motor Nom Current</td>
<td>$I_{rat}$ 159 A</td>
</tr>
<tr>
<td>Motor Nom Freq</td>
<td>$f_{rat}$ 50.31 Hz</td>
</tr>
<tr>
<td>Motor Nom Speed</td>
<td>$n_{rat}$ 1500 rpm</td>
</tr>
<tr>
<td>Motor Nom Power</td>
<td>$P_{rat}$ 3218 hp 2400 kW</td>
</tr>
<tr>
<td>Motor Nom Cos_Fii</td>
<td>$\cos \phi_{rat}$ 0.9</td>
</tr>
</tbody>
</table>

### Equivalent circuit values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stator resistance</td>
<td>$R_1$ 0.00931 Ohm</td>
</tr>
<tr>
<td>Stator stray reactance</td>
<td>$X_{1 \text{ sig}}$ 0.14887 Ohm</td>
</tr>
<tr>
<td>Main (mutual) reactance</td>
<td>$X_{h}$ 4.51457 Ohm</td>
</tr>
<tr>
<td>Rotor resistance</td>
<td>$R_2'$ 0.00650 Ohm</td>
</tr>
<tr>
<td>Rotor stray reactance</td>
<td>$X_{2 \text{ sig}'}$ 0.09311 Ohm</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>$f_n$ 1 Hz</td>
</tr>
</tbody>
</table>

### Summary of Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>AMC</th>
<th>BCON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Nom Voltage</td>
<td>110.1</td>
<td>99.07</td>
</tr>
<tr>
<td>Motor Nom Current</td>
<td>110.2</td>
<td>99.06</td>
</tr>
<tr>
<td>Motor Nom Freq</td>
<td>110.3</td>
<td>99.08</td>
</tr>
<tr>
<td>Motor Nom Speed</td>
<td>110.4</td>
<td>99.09</td>
</tr>
<tr>
<td>Motor Nom Power</td>
<td>110.5</td>
<td>99.10</td>
</tr>
<tr>
<td>Motor Nom Cos_Fii</td>
<td>110.6</td>
<td>99.11</td>
</tr>
<tr>
<td>$R_s$</td>
<td>150.1</td>
<td>-</td>
</tr>
<tr>
<td>$L_s$</td>
<td>150.2</td>
<td>-</td>
</tr>
<tr>
<td>$\Sigma L_s$</td>
<td>150.3</td>
<td>-</td>
</tr>
<tr>
<td>Rotor time</td>
<td>150.4</td>
<td>-</td>
</tr>
<tr>
<td>$R_u$</td>
<td>98.02</td>
<td>-</td>
</tr>
<tr>
<td>$R_r$</td>
<td>98.03</td>
<td>0.00931 p.u.</td>
</tr>
<tr>
<td>$L_m$</td>
<td>98.04</td>
<td>4.51457 p.u.</td>
</tr>
<tr>
<td>$\Sigma L_u$</td>
<td>98.05</td>
<td>0.24009 p.u.</td>
</tr>
</tbody>
</table>

### Current Controller Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>AMC</th>
<th>BCON</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_s$</td>
<td>0.0005 s</td>
<td></td>
</tr>
<tr>
<td>Current Ctrl Filter</td>
<td>-</td>
<td>37.31 150 Hz</td>
</tr>
<tr>
<td>$T_m$</td>
<td>-</td>
<td>0.00156</td>
</tr>
<tr>
<td>Current Ctrl P-Gain</td>
<td>-</td>
<td>37.32 0.243 p.u.</td>
</tr>
<tr>
<td>Current Ctrl Ti</td>
<td>-</td>
<td>37.33 48.8 ms</td>
</tr>
</tbody>
</table>
• Record operation trend and add it to report with comments.

- Grid loss ride through test
  Test Grid loss ride-through. Test with the driven machine coupled and with load, if possible.

  **NOTICE!** Grid loss ride through test is not the standard commissioning task, which is only for the particular project permitted by MV Drives Supportline. The MCB will open and close automatically during the test. Don’t set Par 82.81 lower than 2s because it might cause the drive to trip.

  - Connect the Drive composer, add following signals to monitoring window: motor current, Trafo current, motor actual speed, DC link voltage, etc.
  - Set Par 82.81 Ride through test time to achieve approx. 5s. The ride-through time equals this parameter plus the time needed for the MCB to close.
  - Set the speed reference in Drive composer to rated motor speed.
  - Start the drive. Change Par 82.80 Ride through test to Enabled while rated motor speed is reached. The MCB opens and closes after specified time. The drive should not trip due to overcurrent (motor or transformer). The DC voltage should be below limit at all time. After MCB is closed motor speed should return to rated value without overshoot.

**Finalizing the commissioning**

- Parameters backup
  - Export parameters to a .prn file using DriveStartup option Parameters/Export.
  - Use Drive composer tool to save parameter backup file. Recommend to save 2 types of backup file, the customer access level and the service access level.
• Save all the files in project folder and attach to the report.
• According to customer preferences, set the control panel language, parameter 96.01 Language.
• Save the parameter backup in ACS-AP-W/S panel. Option: Menu/Backups/Create backup.

- **SD card data backup**

  - Copy the Date from the SD memory card to PC.
  
  Refer to Maintenance in ACS580MV Hardware Manual (2UBB004520), section “Replacing the SD memory card”.

- **Spare parts software version**

  Before leaving the site, the customer spare parts are to be checked against the bill of material. If spare parts have not been ordered at all, the commissioning report is to be marked accordingly.

  Spare parts of the customer containing software (BCON, ACS-AP-W/S, CVMI2, IO Controller, Control hub) are to be updated with the versions of the software and the parameters used in the converter.

- **Customer training**

  If not agreed by contract otherwise, the subjects listed below can be used as a guide when organizing on-site training of operational staff. The training can be based on the Operation of ACS580MV Hardware Manual (2UBB004520).
• Safety training
• Overview of the system and cabinet
• Door interlocking system
• Control panel
  a. Reading and interpreting status, alarm and fault messages
  b. Control modes (local/remote)
• Energizing and starting the converter
• Stopping and de-energizing the converter
• General maintenance work
• Exchange the power modules
• Install the Drive composer entry
  a. Save the parameter file and event logger
  b. Monitor the graph
  c. Create the support package
• Copy the SD card date from the drive
• Standard troubleshooting process and where to get help

Customer approval

After the test runs have been performed and the Commissioning Report has been filled in completely, the representative of the customer is asked to confirm the end of the commissioning with his/her signature on the report.

Date and signature on the report will indicate the beginning of the warranty period to the factory.

Create the commissioning report

Complete all the steps of commissioning work. Remark all the details uncompleted and inform the project manager and MV Drives Supportline.
• Create report by going to menu Reports and select report type.

Prepare the Field service report by DriveStartup

Please download the latest Field Service Report template (version 2.0 or newer) from the MV Drives Portal Software Station and only use the latest version for all future reports. When you create a DriveStartup project, please include the field report with the drive commissioning packages.

• Open the DriveStartup, add the Field Service Report template through the menu: View/Package Manager.
• Create the new project. In the step ‘Service provider’, fill in the email and password to connect to MoR database. If the service work is performed by another engineer, fill out the full information.

• After loading the data from MoR database, suggest to review the drive information and service history through the installed base information.
• Pay more attention to the ‘Recommended Services’ and ‘Updates’, contact MV Drives Supportline if necessary.

• If the drive is not registered to a site/customer in ServIS, the Registration step appears. Please locate the correct site with the link in ServIS and copy the Site ID to the ServIS Site ID box. After you upload the report, MoR moves drive to the site in ServIS.

• The BoM which includes the serial numbers of the most important components can be synchronized by the field service report.
90 Standard Commissioning Process

When a component is changed, the new serial number should be reported. If a component is added, removed or replaced with a different part number, this is updated in the BOM in order to show what is currently installed in the drive. Fill in the responding information in the blanks below.

• If the serial number and position number of the ‘fault material’ is just the same with the ones in original BOM, fill in ‘right’ in ‘part status’, if not, fill in ‘wrong’. After saving the date, the material which has been revised will changed as picture below. Make sure the serial number of the Material you return to factory is filled in correctly.
**Note:** If you have spare time while you are on-site, please take a moment to update the part lists with the correct part locations in order to improve the quality of our data.

- All the drive data that is collected in 'Drive Data and Software' step should be added to the table, including the firmware and software version of AC500eco, ACS-AP-S/W, BCON, CVMI2 and Control hub.

- The parameter backup, parameter export and SD card data of BCON should be added to the table also.

- Complete and upload all the information and data described in the steps.
Note: Select the correct drive status in step Service summary. Which would impact the drives life time management in MoR database.

- Return to the step ‘Reports and attachment’. Create the service report and field service report by going to menu Reports and select report type.
Complete the site condition report ‘2UBB021641_ACS580MV Drive and Site Condition Check List’, together with the commissioning report (service report) and field service report, add to the attachment.

Update all the drive data and reports to MoR by pressing 'Upload ALL to Installed base (MoR)' button.
Customer documentation

The following documentation stays with to the customer after the commissioning:

- Copy of the commissioning report.
- Copy of the parameter backup files:
  a. .prn (txt) file, customer access level
  b. .dcparamsbak file, service access level
- Copy of the signal and parameter table in electronic format

Note: Make sure that the correct version stays with the customer.
- Copy of modified parts list, mechanical and electrical drawings if any.

Documentation and backup copies to MV Drives Supportline

For revising and archiving of the factory documentation and for later assistance of the customer send the following to the MV Drives Supportline:

- Copy of the commissioning report (MoR database)
- Copy of the field service report (MoR database)
- 2UBB021641_ACS580MV Drive and Site Condition Check List' (MoR database)
- Copy of the parameter backup files (MoR database):
  a. .prn (txt) file, customer access level
  b. .dcparamsbak file, service access level
- SD card data (MoR database)
- Copy of modified parts list, mechanical and electrical drawings if any.
- Warranty report(s) of replaced components if any.

Duration and description of commissioning

The time schedule describes a typical ACS580MV commissioning (excluding special options like synchronized bypass etc.). To be able to follow the schedule, the preconditions must be fulfilled. Commissioning of the drive must be done by a certified engineer.
## Duration and description of typical commissioning

<table>
<thead>
<tr>
<th>Description</th>
<th>Duration¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preparations</strong></td>
<td></td>
</tr>
<tr>
<td>• Collecting information about the drive system (electrical part list, wiring diagrams, application notes etc.)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>4 hours</td>
</tr>
<tr>
<td>• Preparing the needed software and drive license.</td>
<td></td>
</tr>
<tr>
<td><strong>Note:</strong> the commissioning preparations does not include any practical travel arrangement etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Pre-commissioning</strong></td>
<td>12 hours</td>
</tr>
<tr>
<td>• Checking the environment of electrical room (Safety, cooling capacity etc.)</td>
<td></td>
</tr>
<tr>
<td>• Checking mechanical installation of the converter, supply transformer, motor and MCB</td>
<td></td>
</tr>
<tr>
<td>• Checking power cables installation (routing, length, dimensioning etc.)</td>
<td></td>
</tr>
<tr>
<td>• Checking the grounding cables installation (earth and equipotential cables)</td>
<td></td>
</tr>
<tr>
<td>• Performing insulation tests on all drive system components. (if drive stock more than six months)&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>• Switching on auxiliary voltage to the converter</td>
<td></td>
</tr>
<tr>
<td>• Programming the converter</td>
<td></td>
</tr>
<tr>
<td>• Checking the interface (I/O, field bus etc.)&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Cold commissioning</strong></td>
<td>4 hours</td>
</tr>
<tr>
<td>• Testing the MCB interface</td>
<td></td>
</tr>
<tr>
<td>• Bypass function testing (if installed)</td>
<td></td>
</tr>
<tr>
<td>• Charging the converter DC link</td>
<td></td>
</tr>
<tr>
<td><strong>Hot commissioning</strong></td>
<td>8 hours</td>
</tr>
<tr>
<td>• Operating the converter locally (with or without load)</td>
<td></td>
</tr>
<tr>
<td>• Operating the converter remotely</td>
<td></td>
</tr>
<tr>
<td>• Operating the converter remotely with the driven load connected</td>
<td></td>
</tr>
<tr>
<td>• Checking operation in normal operation, including flying start, ride through, etc.)</td>
<td></td>
</tr>
<tr>
<td><strong>Closing work</strong></td>
<td>4 hours</td>
</tr>
<tr>
<td>• Finalizing commissioning and travel reports</td>
<td></td>
</tr>
<tr>
<td>• Customer training (basic operation and safety)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>32 hours</td>
</tr>
</tbody>
</table>

Remarks:

1. The estimated times depends mainly on the state of the installation and the customer readiness and does not include any waiting time, travel time etc.
2. The insulation tests on motor, MCB and power cables can be performed by the customer, in that case signed test reports must be available.
3. An overriding control system specialist must be available to be able to check I/O, field bus interfaces and other signals.
Option

MBU Commissioning

Manual bypass is an option used as a backup for a drive failure (e.g. a trip) or drive maintenance, then the motor can be switched to bypass (DOL) mode.

As standard option there are 3 types shown as below,

- MBU=0001 Line-up manual version (with isolation switches)
- MBU=0002 Line-up electrical operated manual bypass (with vacuum contactors)
- MBU=0003 Line-up premium electrical operated manual bypass
Configuration of drive and bypass for MBU=0001 and MBU=0002 or MBU=0003

**DANGER** Three isolation switches are forbidden to be operated when MCB is closed. Illegal operation will result in death or serious injury. The position of the knives must be checked through the observation window after operation to make sure they are in the right position.

To harmonize the voltage level of customer interface for MCB status, MCB open and ready status interface update from 24V to 230V which same as MCB close status. If customer need set common point for MBU/ABU, please set X210/X310:1,3,5 as common point. Please double-checking schematics, IO interface and the customer wiring before commissioning due to customer interface changed. If drive still using old design, please make sure pin3 or pin4 cannot have common grounding with pin1, pin2, pin5 and pin6.
### Customer interface or MBU (New)

<table>
<thead>
<tr>
<th></th>
<th>Internal supply:230 VAC,0.25A</th>
<th>MCB Close Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>MCB Open Status</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>MCB Ready Status</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Internal supply:230 VAC,0.25A</td>
<td>MCB Close Status</td>
</tr>
<tr>
<td>2</td>
<td>MCB Open Status</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>MCB Ready Status</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>MCB Ready Status</td>
<td></td>
</tr>
</tbody>
</table>

### Customer interface or ABU (Old)

<table>
<thead>
<tr>
<th></th>
<th>Internal supply:24 VDC,20 mA</th>
<th>MCB Close Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>MCB Open Status</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>MCB Ready Status</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MCB Open Status</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>MCB Ready Status</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>MCB Ready Status</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>MCB Ready Status</td>
<td></td>
</tr>
</tbody>
</table>

### Customer interface or ABU (New)

<table>
<thead>
<tr>
<th></th>
<th>Internal supply:230 VAC,0.25A</th>
<th>MCB Close Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>MCB Open Status</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>MCB Ready Status</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MCB Open Status</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>MCB Ready Status</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>MCB Ready Status</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>MCB Ready Status</td>
<td></td>
</tr>
</tbody>
</table>

---

**New relay for Manual bypass unit upgrade**
100 Option

- **Insulation test**
  The insulation test is not recommended, if necessary check the description in *Insulation Resistance Measurements.*

- **Commissioning for MBU=0001 option**
  - Confirm the MCB has been racked out and grounded.
  - Ground the input busbar in TRU cabinet by grounding harness for safety.
  - Connect the control cables among the MCB, MBU and COU cabinet.
  - Disable the local close push button on MCB cabinet.
  - Connect the auxiliary control power supply to the cabinet.

- **Check of the isolation switches position**
  - Follow the operation sequence, operate the switches of QS1(Q1), QS2(Q2) and QS3(Q3).
• Check all three switches can fully close after ‘close switches operation’. The movable contacts can fully contact the stationary contacts, below pictures show one passed case and failed cases.

[Passed case and failed case images]

• Check all three switches can fully open after ‘open switches operation’. The clearance between open contacts should be bigger than 150mm.

Check of the logic and lamp status

For lamp test, the cabinet shall be fed Auxiliary supply, and close Q7101 and Q7151. The lamps status can be checked as below table.

<table>
<thead>
<tr>
<th>Item</th>
<th>QS1(Q1) open</th>
<th>QS2(Q2) open</th>
<th>QS3(Q3) close</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aux Supply lamp</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>QS1(Q1)_close lamp</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>QS1(Q1)_open lamp</td>
<td>On</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>QS2(Q2)_close lamp</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>QS2(Q2)_open lamp</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>QS3(Q3)_close lamp</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>QS3(Q3)_open lamp</td>
<td>Off</td>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
</tbody>
</table>
Check of the humidity sensor and space heater

- For this test, the cabinet should be fed Auxiliary supply, and close Q7151.
- Adjust the setting of the humidity sensor A7151(B7151) to an appropriate value, which is nearby the ambient humidity, and the indicator lamp of the sensor should be on, the space heater E7151 shall be powered on and start to work.
- Once passed the test, adjust the setting of sensor A7151(B7151) to 75.

Check of the MBU logic with the drive

- Confirm the MCB is at the test position, select the ‘VSD mode’. Close the MCB by drive.
- Confirm the MCB is at the test position, select the ‘Bypass mode’. Close the MCB by overriding system.
- Rack in the MCB to the operation position. From this time on the medium voltage can be connect to the MBU and drive.
- Confirm the MCB is open, select the ‘VSD mode’, monitor and run the motor by the drive.
- Confirm the MCB is open, select the ‘Bypass mode’, monitor and run the motor by the overriding system.

**NOTICE** If the drive integrated with MBU cabinet, pay more attention to the ‘Bypass mode’, the rated input current is based on the motor current. In some situation, the setting of protection relay should be modified.

### Commissioning for MBU=0002 or MBU=0003 option

- Confirm the MCB has been racked out and grounded.
- Ground the input busbar in TRU cabinet by grounding harness for safety.
- Connect the control cables among the MCB, MBU and COU cabinet.
- Disable the local close push button on MCB cabinet.
- Connect the auxiliary control power supply to the cabinet.
Check of the contactors operation

- Check the switch S7804 can’t be operated when it is locked at any of three status (Local, Stop and Remote).

- Local, stop and remote mode have interlocked function. Check these functions with special contactor operations as below table, and all the test result shall be ‘X’.

<table>
<thead>
<tr>
<th>Contactors operation</th>
<th>Local mode</th>
<th>stop mode</th>
<th>remote mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Remote operation</td>
<td>Local operation</td>
<td>Remote operation</td>
</tr>
<tr>
<td>KM1(Q1)_close</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>KM1(Q1)_open</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>KM2(Q2)_close</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>KM2(Q2)_open</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>KM3(Q3)_close</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>KM3(Q3)_open</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Note: ‘X’ means the switches status don not change after operating.

- KM1(Q1), KM2(Q2) and KM3(Q3) are designed to interlock electrically. Check these functions with some operation sequences as below table, and the test result shall be same as listed in the below table.

<table>
<thead>
<tr>
<th>Contactors status</th>
<th>S7804: Local status</th>
<th>S7804: Remote status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contactors operate: Local</td>
<td>Contactors operate: Remote</td>
</tr>
<tr>
<td>KM1(Q1) open</td>
<td>close KM1(Q1) ( X )</td>
<td>close KM1(Q1) ( X )</td>
</tr>
<tr>
<td>KM2(Q2) open</td>
<td>close KM2(Q2) ( X )</td>
<td>close KM2(Q2) ( X )</td>
</tr>
<tr>
<td>KM3(Q3) close</td>
<td>open KM3(Q3) ( √ )</td>
<td>open KM3(Q3) ( √ )</td>
</tr>
<tr>
<td>KM1(Q1) open</td>
<td>close KM1(Q1) ( X )</td>
<td>close KM1(Q1) ( X )</td>
</tr>
<tr>
<td>KM2(Q2) open</td>
<td>close KM2(Q2) ( X )</td>
<td>close KM2(Q2) ( X )</td>
</tr>
<tr>
<td>KM3(Q3) open</td>
<td>close KM3(Q3) ( X )</td>
<td>close KM3(Q3) ( X )</td>
</tr>
<tr>
<td>KM1(Q1) close</td>
<td>open KM1(Q1) ( √ )</td>
<td>open KM1(Q1) ( √ )</td>
</tr>
<tr>
<td>KM2(Q2) close</td>
<td>open KM2(Q2) ( √ )</td>
<td>open KM2(Q2) ( √ )</td>
</tr>
<tr>
<td>KM3(Q3) open</td>
<td>close KM3(Q3) ( X )</td>
<td>close KM3(Q3) ( X )</td>
</tr>
</tbody>
</table>

Note:
1. ‘X’ means the switches status don not change after operating.
2. ‘√’ means the switches status shall be changed after operating.
Check of the logic and lamp status

For lamp test, the cabinet shall be fed Auxiliary supply, and close Q7601 and Q7651. The lamps status can be checked as below table.

<table>
<thead>
<tr>
<th>Item</th>
<th>KM1(Q1) open, KM2(Q2) open, KM3(Q3) close Bypass mode</th>
<th>KM1(Q1) open, KM2(Q2) open, KM3(Q3) OFF mode</th>
<th>KM1(Q1) close, KM2(Q2) open, KM3(Q3) open</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aux Supply lamp</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>KM1(Q1)_close lamp</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>KM1(Q1)_open lamp</td>
<td>On</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>KM2(Q2)_close lamp</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>KM2(Q2)_open lamp</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>KM3(Q3)_close lamp</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>KM3(Q3)_open lamp</td>
<td>Off</td>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>VSD mode lamp</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>Bypass mode lamp</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>QF1 close lamp</td>
<td>On: connected X310:3,4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QF1 open lamp</td>
<td>Off: disconnected X310:3,4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Check of the humidity sensor and space heater

- For this test, the cabinet should be fed Auxiliary supply, and close Q7651.
- Adjust the setting of the humidity sensor A7651(B7651) to an appropriate value, which is nearby the ambient humidity, and the indicator lamp of the sensor should be on, the space heater E7651 shall be powered on and start to work.

Once passed the test, adjust the setting of sensor A7651(B7651) to 75.

Check of the MBU logic with the drive

- Confirm the MCB is at the test position, switch the S7804 to ‘Local mode’, set to the ‘VSD mode’. Close the MCB by drive.
- Confirm the MCB is at the test position, switch the S7804 to ‘Remote mode’, set to the ‘VSD mode’. Close the MCB by drive.
- Confirm the MCB is at the test position, switch the S7804 to ‘Local mode’, set to the ‘Bypass mode’. Close the MCB by overriding system.
- Confirm the MCB is at the test position, switch the S7804 to ‘Remote mode’, set to the ‘Bypass mode’. Close the MCB by overriding system.
- Rack in the MCB to the operation position. From this time on the medium voltage can be connect to the MBU and drive.
- Confirm the MCB is open, switch the S7804 to ‘Remote mode’ or ‘Local mode’, set to the ‘VSD mode’, monitor and run the motor by the drive.
• Confirm the MCB is open, switch the S7804 to ‘Remote mode’ or ‘Local mode’, set to the ‘Bypass mode’, monitor and run the motor by overriding system.

**NOTICE** If the drive integrated with MBU cabinet, pay more attention to the ‘Bypass mode’, the rated input current is based on the motor current. In some situation, the setting of protection relay should be modified.

## SBU Commissioning

Synchronized bypass unit (SBU) is an option and used when motors need to be synchronized to main. According to the number of the motors, synchronized bypass function can be divided to two types, single motor mode and multi motor mode. In multi motor mode, marshalling unit (MAU) is necessary. Commissioning for SBU and MAU must be carried out by engineer who has been certified with “Expert”.

### Safety

Obey safety instructions when you install, operate or do maintenance on the bypass-drive system. If you ignore the safety instructions, injury, death or damage can occur. Safety instructions are used to highlight a potential hazard when working on the equipment. Safety instructions must be strictly followed! Non-compliance can jeopardize the safety of personnel, the equipment and the environment. Refer to [Safety instructions](#).

### Software requirements

The Latest software is recommended.

### Inspection of installation

Complete installation checklist before commissioning can take place. See [ACS580MV Hardware Manual](#) (2UBB004520) for other information of installation.

---

**Notice:**

1. Mains and converter output PT should be same type. Single phase PT is recommended. If it’s three phase PT and on second side phase to phase voltage signal is used, below earthing point should be removed (bridge between -X117:2&3, and –X118:2&3).

2. PT1.1 and PT2.1 has to measure the voltage between the same phases (Phase U/V recommended), also PT1.2 if it’s available.
3. Phase order of main supply (MB input side) must be clockwise. The synchronization is only possible if the drive run the motor with a clockwise rotating field. If the motor has to run anti clockwise the phase order has to be changed directly at the motor.

Overview of installation work and check list

- Mechanical installation was completed.
- SBU and MAU free of pollution due to installation.
- Power supply and signal cables for fans in transformer unit.
- Converter control power supply must be 1-phase 230VAC.
- Before closing the control power supply circuit breaker in MAU, measure the incoming auxiliary supply voltage and verify that it is within +/-10% of its nominal value.
- Auxiliary power, ground, control and serial communication cables made properly.
- Options (cabinet heater, CP610, etc.) supply cabling properly made.
- Power cables for SBU functions are made and installed properly (including converter output to MSS, MSS to motor, MB to motor, grid to MB).
- Interface cables for SBU function (control device to ACS580MV) are properly made.

■ Insulation test

The insulation test is not recommended, if necessary check the description in Insulation Resistance Measurements.

■ Download software

Marshalling PLC software

Marshalling PLC is optional, just for multi motor mode. As Loading software and prepare DriveStartup described, take the loading package for the latest software release and download to Marshalling PLC using the same procedure as to AC500 of ACS580MV.
CP610 software

Download the SW to Panel (CP610) if it has this option as below.

- Save the following file to root folder of a USB disk.

<table>
<thead>
<tr>
<th>Name</th>
<th>Date modified</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>UpdatePackage.zip</td>
<td>1/17/2018 3:00 PM</td>
<td>WinZip File</td>
</tr>
</tbody>
</table>

- Switch off the control power.
- Plug in the USB disk to the HMI device CP610.
- Switch on the control power.
- Display the context menu by holding your finger for a few seconds on the screen and then select Update.
- The panel system will check for the presence of the program package in the USB disk root folder and ask for update.

  ![HMI Update Wizard](image)

  - Select Auto select best match and click next. The update will start automatically.
  - On the CP610 press an empty area of the screen for a few seconds to display the context menu.
  - Select "Show system setting", then set the IP address and Subnet mask on edit mode
    IP: 192.168.0.11, Subnet mask: 255.255.255.0
SBU phase order check procedure

Phase order check for main circuit

NOTICE! Main circuit order check is important and it’s more of engineering practice how it’s conducted, which is common to all other products with SBU function, instead of something specially for ACS580MV; Meanwhile, SBU commissioning needs to count on expertise of FSE to judge on site which method is safe/applicable and easy to carry out, most of the time, a common method will not work out.
Below is an example (available when SBN=0001):

1. Confirm that the upper side phase order of MCB and MB1 are clockwise (customer’s responsibility);
2. Disconnect the motor cable at the motor side;
3. Short-circuit both the input cable and output 3 phases cables of the VFD one by one;
4. Close MSS1 (in test position);
5. Check the underside phase order of MCB and MB1 with multimeter at measuring points one by one. Make sure the phase order of this circuit is correct.
6. Check other main circuits phase order as the same procedure one by one (if SBM>=0002)

**Phase order check for PTs**

1. Check the primary cable connection of PTs and make sure the phase order is correct.
2. Check the wirings connection between the secondary side of PTs and Rsyc-01 board. Make sure the phase order is correct.
Phase order check for measuring circuit

1. Disconnect the input cables from -X117:1, -X117:2, -X118:1, -X118:2;
2. Remove the bridge between -X117:2 -X117:3, -X118:2 -X118:3 if available (SBP=0001, PTs provided by ABB);
3. Connect the test circuit as above, two single phase breakers (-Q1 and -Q2) are proposed to be added between 220Vac and terminal -X107(or-X117) and -X108 (or -118) for safety and easy controlling;
4. Power on +24Vpower supply of drive and make sure control power is OK for Rsyc-01 board (-A6141:J1);
5. Close -Q1 and check that indication lamp of SYNC is off and BCON DI6 is low;
6. Close -Q2 and check if the indication lamp of SYNC is on and BCON DI6 is high (ON means phase sequence is correct for both measurement loop from -X107 & -X108 to Rsyc-01 board).
7. If SYNC is not ON, check phase sequence of the cable connection between -X107(or X118), -X108(or X118) and Rsyc-01 board, correct the cable connection and redo the test. Other failure modes include: fuse broken (-X107, -X108, -X117, X118 and -X109), phase sequence of isolating transformer (-T6141 and -T6142) is not correct, this can be conducted and distinguish step by step;
8. If SYNC is ON for Rsyc-01 board but DI6 is low for BCON, then check the cable connection between Rsyc-01 board and BCON following schematic;
9. Recover the wiring after test is successfully finished.

SYNC indication lamp position
**SBU Cold commissioning**

**Set SBU parameter**

- Use the standard AI2 as the RSYNC-01 board BUF_OUT signal interface. Select AI2 unit selection to V on the front of the BCON.

- Set parameters for MSS and MB control.

  Set following parameters via drive startup:

<table>
<thead>
<tr>
<th>Drive Parameter</th>
<th>setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.01 Module 3 type</td>
<td>FIO-01</td>
<td>FIO-01 is added and in position 3 for SBU function.</td>
</tr>
<tr>
<td>12.25 AI2 unit selection</td>
<td>V</td>
<td>Set unit to V</td>
</tr>
<tr>
<td>12.27 AI2 min</td>
<td>0V</td>
<td>Set AI2 min value. Voltage range of RSYNC-01 BUF OUT is 0~10V.</td>
</tr>
<tr>
<td>12.28 AI2 max</td>
<td>10V</td>
<td>Set AI2 max value</td>
</tr>
<tr>
<td>16.19 DIO3 function output source</td>
<td>Output</td>
<td>Select DIO3 as output. If two signals (open and close) are used for MSS control, this parameter needs to set.</td>
</tr>
<tr>
<td>16.21 DIO3 output source</td>
<td>P 85.2.14</td>
<td>MSS open command signal is from SBU function SW bit 14. If two signals (open and close) are used for MSS control, this parameter needs to set.</td>
</tr>
<tr>
<td>16.24 DIO4 function output source</td>
<td>Output</td>
<td>Select the DIO4 as the output. If two signals (open and close) are used for MB control, this parameter needs to set.</td>
</tr>
<tr>
<td>16.26 DIO4 output source</td>
<td>P 85.2.15</td>
<td>MB open command signal is from SBU function SW bit 15. If two signals (open and close) are used for MB control, this parameter needs to set.</td>
</tr>
<tr>
<td>16.34 RO1 source</td>
<td>P 85.2.12</td>
<td>MSS close command is from SBU function SW bit 12</td>
</tr>
<tr>
<td>16.37 RO2 source</td>
<td>P 85.2.13</td>
<td>MB close command is from SBU function SW bit 13</td>
</tr>
<tr>
<td>19.11 Ext1/Ext2 selection</td>
<td>EXT1</td>
<td>Sync to main only works in external control (EXT1 or EXT2).</td>
</tr>
<tr>
<td>Drive Parameter</td>
<td>setting</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>20.01 Ext1 commands</td>
<td>Control panel</td>
<td>Select control commands source of external control location EXT1.</td>
</tr>
<tr>
<td>22.11 Speed ref1 source</td>
<td>Control panel</td>
<td>Select speed reference source of external control location EXT1.</td>
</tr>
<tr>
<td>20.24 Negative speed enable not selected</td>
<td>Not selected</td>
<td>Disable negative speed.</td>
</tr>
<tr>
<td>21.03 Stop mode</td>
<td>Coast</td>
<td>Select the way of motor stop.</td>
</tr>
<tr>
<td>28.11 Frequency ref1 source</td>
<td>Control panel</td>
<td>Select the speed reference source for external control location EXT1.</td>
</tr>
<tr>
<td>30.11 Minimum speed</td>
<td>0</td>
<td>Define the minimum allowed motor speed.</td>
</tr>
<tr>
<td>30.12 Maximum speed</td>
<td>3600 (example)</td>
<td>Define the maximum allowed motor speed. Maximum speed must be higher than motor nominal speed, so that converter output voltage frequency can be adjusted around the mains frequency.</td>
</tr>
<tr>
<td>30.13 Minimum frequency</td>
<td>0</td>
<td>Define the minimum allowed motor frequency.</td>
</tr>
<tr>
<td>30.14 Maximum frequency</td>
<td>60</td>
<td>Define the maximum allowed motor frequency. Maximum frequency must be higher than motor nominal frequency, so that converter output voltage frequency can be adjusted around the mains frequency.</td>
</tr>
<tr>
<td>85.05 Ratio of grid voltage transducer</td>
<td>100</td>
<td>Define the ratio of grid PT (potential transformer). For example, if the ratio of PT is 11000V / 110V, set this value to 100. If the PT is provided by ABB, the type is RZL10 (11000V / 110V).</td>
</tr>
<tr>
<td>85.06 Ratio of converter voltage transducer</td>
<td>100</td>
<td>Refer to 85.05.</td>
</tr>
<tr>
<td>85.11 SBU function enable</td>
<td>enable</td>
<td>Enable SBU function.</td>
</tr>
<tr>
<td>85.12 Motor control mode</td>
<td>Single motor (example)</td>
<td>If no MAU PLC is selected (MSS, MB control signals are from FIO-01), set it to Single motor. In Single motor mode, feedbacks of MSS and MB are monitored by BCU. If MAU PLC is selected (MSS, MB control signals are from MAU PLC), set it to Multi motor. In Multi motor mode, feedbacks of MSS and MB are monitored by MAU PLC, instead of BCU.</td>
</tr>
<tr>
<td>85.13 SBU control source</td>
<td>IOs control</td>
<td>Select SBU control source. <strong>IOs control</strong> means: BCU DI2 0 →1, start Sync to main; BCU DI4 1→0, open MB (85.12 Motor control mode is Single motor and 85.20 MB open by direct online is Enabled). <strong>Fieldbus control</strong> mains Sync to main and MB open command is from 85.01 SBU control and monitoring CW.</td>
</tr>
<tr>
<td>85.14 MB control signal</td>
<td>Steady signal</td>
<td>Select MB control signal. If it's pulse signal, pulse time is 3s. For Multi motor, steady signal is necessary.</td>
</tr>
<tr>
<td>85.15 MSS control signal</td>
<td>Steady signal</td>
<td>Select MSS control signal. If it's pulse signal, pulse time is 3s. For Multi motor, steady signal is necessary.</td>
</tr>
</tbody>
</table>
Option 113

- Set parameters for inductor bypass contactor.

If inductor bypass contactor is used as a c-plus option, below parameters need to be set. Inductor bypass contactor can only be used when MB and MSS are steady signal control (one coil control).
Set MAU PLC parameters.

If more than one motors are to be sync to mains, marshalling PLC (optional) is used. It provides parameters, events and IO signals interface to user. Web visualization is used as interface of marshalling PLC.

Requirements for commissioning PC

1. In order to access PLC, user’s computer has to meet below conditions.
   - Operating system: Windows NT/2000/XP/7/10, Windows CE, Linux, RTE.
   - A Web-Browser (IE-Explorer or Netscape)
   - JavaScript is installed on PC. The Java.exe installation could be downloaded from the official website https://www.java.com/en/

2. IP address and Subnet mask setting
   - Connect Marshalling PLC and PC with ethernet cable.
   - Set Marshalling PLC (optional) and Panel (optional) as below table.

<table>
<thead>
<tr>
<th>Drive parameter</th>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.19 DIO3 function</td>
<td>Output</td>
<td>Select DIO3 as output</td>
</tr>
<tr>
<td>16.21 DIO3 output source</td>
<td>P 85.2.14</td>
<td>Inductor bypass contactor close command signal is from SBU function SW bit 14</td>
</tr>
<tr>
<td>16.24 DIO4 function</td>
<td>Output</td>
<td>Select the DIO4 as the output</td>
</tr>
<tr>
<td>16.26 DIO4 output source</td>
<td>P 85.2.15</td>
<td>Inductor bypass contactor open command signal is from SBU function SW bit 15</td>
</tr>
<tr>
<td>85.21 Bypass contactor control</td>
<td>Enabled</td>
<td>Enable inductor bypass contactor control</td>
</tr>
<tr>
<td>85.22 Contactor control signal</td>
<td>Pulse signal</td>
<td>Inductor bypass contact is using pulse signal for control</td>
</tr>
</tbody>
</table>

- set the PC IP address in the same segment, e.g. 192.168.0.13, and with same Subnet mask.
3. Marshalling PLC parameter setting

The following parameters are necessary.

<table>
<thead>
<tr>
<th>Marshalling PLC parameter</th>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Par.1 Control source</td>
<td>IOs control (example)</td>
<td>Select Marshalling PLC control source.</td>
</tr>
<tr>
<td>Par.2 Number of motors</td>
<td>2 (example)</td>
<td>Define number of motors.</td>
</tr>
<tr>
<td>Par.3 MB feedback signal</td>
<td>TWO (example)</td>
<td>Define how many feedback signals MB has.</td>
</tr>
<tr>
<td>Par.4 MSS feedback signal</td>
<td>TWO (example)</td>
<td>Define how many feedback signals MSS has.</td>
</tr>
<tr>
<td>Par.5 MB command signal</td>
<td>Pulse (example)</td>
<td>Define control signals type of MB.</td>
</tr>
<tr>
<td>Par.6 MSS command signal</td>
<td>Pulse (example)</td>
<td>Define control signals type of MSS.</td>
</tr>
<tr>
<td>Par.7 MB pulse time</td>
<td>3s (example)</td>
<td>Define pulse time of MB control signal.</td>
</tr>
<tr>
<td>Par.8 MSS pulse time</td>
<td>3s (example)</td>
<td>Define pulse time of MSS control signal</td>
</tr>
<tr>
<td>Par.9 MB close time limit</td>
<td>3s (example)</td>
<td>Define maximum operating time for closing MB</td>
</tr>
</tbody>
</table>
Connect the Marshalling PLC and PC with Ethernet cable.

Open [http://192.168.0.10/webvisu.htm](http://192.168.0.10/webvisu.htm) by Internet Explorer to show Web visualization.

Input service level pass code in Par.24.

<table>
<thead>
<tr>
<th>Marshalling PLC parameter</th>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Par.10 MSS close time limit</td>
<td>3s (example)</td>
<td>Define maximum operating time for closing MSS</td>
</tr>
<tr>
<td>Par.11 MB open time limit</td>
<td>3s (example)</td>
<td>Define maximum operating time for opening MB</td>
</tr>
<tr>
<td>Par.12 MSS open time limit</td>
<td>3s (example)</td>
<td>Define maximum operating time for opening MSS</td>
</tr>
<tr>
<td>Par.13 MSS close waiting time</td>
<td>5s (example)</td>
<td>Define the MSS operating waiting time, after switching off the motor.</td>
</tr>
<tr>
<td>Par.14 Motor grid configure</td>
<td>External (example)</td>
<td>Two grids are supported. This parameter defines the grid selection command source. <strong>External</strong> means it’s from DI (X106: 1, 2). <strong>Parameter</strong> means it’s from Motor1 grid selection... Motor8 grid selection.</td>
</tr>
<tr>
<td>Par.23 PLC IO refresh</td>
<td>Done (example)</td>
<td>In case PLC reports F002 PLC IO configuration fault, refresh PLC configuration to match actual IO modules. After refreshing, PLC will reboot and configure correct hardware. This parameter will be displayed only if PLC has IO configuration fault.</td>
</tr>
<tr>
<td>Par.50 Motor 1 user set</td>
<td>UserSet1 (example)</td>
<td>This parameter selects the user set for this motor. Two types of motors are supported and user set is used to select the corresponding motor data. The command is from marshalling PLC to BCU DI5, to select user set. Every time after Motor group 1...8 selection is set, marshalling PLC will select corresponding use set. Detailed steps: 1. Using motor data 1 for commissioning. 2. Set 96.11 User set save/load to Save to set 1. After saving is finished, it will change to No action. 3. Set motor data 2 (99.06...99.11). 4. Set 96.11 User set save/load to Save to set 2. After saving is finished, it will change to No action. 5. Set 96.12 User set I/O mode in1 to DI5. 96.11 User set save/load to User set I/O mode. 96.10 User set status will show the user set selected by marshalling PLC.</td>
</tr>
<tr>
<td>Par.51 Motor 1 grid selection</td>
<td>External (example)</td>
<td>This parameter selects the grid for this motor. It works only when Par. 14 Motor grid configure is Parameter.</td>
</tr>
<tr>
<td>Par.52 MB1 open DOL enable</td>
<td>Disable (example)</td>
<td>Parameter selects if MB1 open command is set if the direct online (DOL) signal is removed (1→0).</td>
</tr>
<tr>
<td>Par.53 MB1 close DOL enable</td>
<td>Disable (example)</td>
<td>Parameter selects if MB1 close command is set if the direct online (DOL) signal is set (0 →1).</td>
</tr>
<tr>
<td>Set for motor 2 to motor 8</td>
<td></td>
<td>If SBM&gt;=0002</td>
</tr>
</tbody>
</table>
• Select "system" to set Marshalling parameters through the user interface as following pictures.

**System Configuration**

**Note:** It is important to set Par.2 number of motors at first. More Marshalling PLC parameters, please refer to *ACS580MV Marshalling Unit firmware manual* (2UBB005340).

• Select "Motor1-4" and "Motor5-8" to set motors parameters according to Par.2, the quantity of the motors.
Note: In case Marshalling PLC reports **F002 PLC IO module fault**, refresh **Par16 PLC IO refresh**, to match actual IO modules. After refreshing, Marshalling PLC will reboot and be configured to correct HW variants.

**Customer interface**

SBU marshalling PLC has 3 control sources: IOs control, Fieldbus control and Panel control.

1. IOs control source

From the PLC hardware configuration, below IO signals are defined for customer control and monitoring. These command signals are available when **Parameter 1 Control source selects IOs**.

<table>
<thead>
<tr>
<th>Position</th>
<th>Type</th>
<th>Number</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMB CPU</td>
<td>PM556-TP-ETH</td>
<td>D12</td>
<td>Reset</td>
</tr>
<tr>
<td>EMB P1</td>
<td>PM556-TP-ETH</td>
<td>D11</td>
<td>Motor 1 selection</td>
</tr>
<tr>
<td>EMB P1</td>
<td>D1562</td>
<td>D12</td>
<td>Motor 2 selection</td>
</tr>
<tr>
<td>EMB P1</td>
<td>D1562</td>
<td>D13</td>
<td>Motor 3 selection</td>
</tr>
<tr>
<td>EMB P1</td>
<td>D1562</td>
<td>D14</td>
<td>Motor 4 selection</td>
</tr>
<tr>
<td>EMB P1</td>
<td>D1562</td>
<td>D15</td>
<td>Motor 5 selection</td>
</tr>
<tr>
<td>EMB P1</td>
<td>D1562</td>
<td>D16</td>
<td>Motor 6 selection</td>
</tr>
<tr>
<td>EMB P1</td>
<td>D1562</td>
<td>D17</td>
<td>Motor 7 selection</td>
</tr>
<tr>
<td>EMB P1</td>
<td>D1562</td>
<td>D18</td>
<td>Motor 8 selection</td>
</tr>
<tr>
<td>EMB P1</td>
<td>D1562</td>
<td>D19</td>
<td>Motor 1 direct online</td>
</tr>
<tr>
<td>EMB P1</td>
<td>D1562</td>
<td>D110</td>
<td>Motor 2 direct online</td>
</tr>
<tr>
<td>EMB P1</td>
<td>D1562</td>
<td>D111</td>
<td>Motor 3 direct online</td>
</tr>
<tr>
<td>EMB P1</td>
<td>D1562</td>
<td>D112</td>
<td>Motor 4 direct online</td>
</tr>
<tr>
<td>EMB P1</td>
<td>D1562</td>
<td>D113</td>
<td>Motor 5 direct online</td>
</tr>
</tbody>
</table>
2. Fieldbus control source

Marshalling PLC supports Modbus RTU fieldbus protocol (optional). The PM556-eCo PLC is working as a server role in communication application. COM2 HW interface is available and used for physical link when **Parameter 1 Control source** selects Fieldbus control source.

<table>
<thead>
<tr>
<th>Position</th>
<th>Type</th>
<th>Number</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMB P1</td>
<td>DI562</td>
<td>DI14</td>
<td>Motor 6 direct online</td>
</tr>
<tr>
<td>EMB P1</td>
<td>DI562</td>
<td>DI15</td>
<td>Motor 7 direct online</td>
</tr>
<tr>
<td>EMB P1</td>
<td>DI562</td>
<td>DI16</td>
<td>Motor 8 direct online</td>
</tr>
</tbody>
</table>

**Fieldbus configuration**

**Communication parameter setting**

<table>
<thead>
<tr>
<th>Access type</th>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read date</td>
<td>SW1</td>
<td>%MW0.100</td>
</tr>
<tr>
<td></td>
<td>SW2</td>
<td>%MW0.101</td>
</tr>
<tr>
<td></td>
<td>SW3</td>
<td>%MW0.102</td>
</tr>
<tr>
<td></td>
<td>SW4</td>
<td>%MW0.103</td>
</tr>
<tr>
<td></td>
<td>FW1</td>
<td>%MW0.104</td>
</tr>
<tr>
<td></td>
<td>FW2</td>
<td>%MW0.105</td>
</tr>
<tr>
<td>Write date</td>
<td>CW1</td>
<td>%MW0.0</td>
</tr>
<tr>
<td></td>
<td>CW2</td>
<td>%MW0.1</td>
</tr>
</tbody>
</table>

Access data setting for communication

For status word, control word and fault word please refer to **ACS580MV Marshalling Unit firmware** (2UBB005340).

3. Panel control source

Panel control is an option for customers. The control interface is applied only when
**Parameter 1 Control source** selects Panel.

**NOTICE** Only after user logs in, the control command can be sent to system.

You can see all the panel interface after you log in the system as below.
IO signals
Panel control interface

System fault
System fault history

For parameters setting details please reference to 2UBB005340 ACS580MV Marshalling Unit firmware.

Circuit breaker tests

DANGER The MCB, MSS, MB must stay in TEST position during the following test! Make sure that MB should have hardwiring interlock with MSS, MSS cannot close when MB is closed. MSS cannot connect to ground in case of MB is closed.

Test all circuit breakers, including MCB, MSS, MB, in test position and test the control and feedback, by forcing corresponding IOs.

- For single motor mode,
  a. Keep parameter 85.12 to single motor mode.
  b. Keep other SBU parameters.
  c. MSS will close and open same following MCB.

- For multi motor mode,
  a. Set and save 85.12 to multiple motors mode.
  b. Make sure 85.14 is set to Steady signal.
  c. Make sure 85.15 is set to Steady signal.
  d. Connect your PC with marshalling PLC.

Motor selection set will close corresponding MSS, and motor selection unset will open corresponding MSS. MB can be controlled by DOL signal after enabling corresponding MB open DOL and MB close DOL functions.
SBU Hot commissioning

**DANGER** From this step MCB and all of MB, MSS is in normal position and controlled only by ACS580MV. Medium voltage can be connected to the converter! Confirm safety area of motor is cleared and auxiliary equipment of motor is in operation.

VSD mode test
Close MSS and test VSD mode first according to VSD test steps.
For single motor mode, MSS will close and open same following MCB.
For multi motor mode, motor selection set will close corresponding MSS, and motor selection unset will open corresponding MSS.

Sync bypass test

- For single motor mode
  Make sure parameter 85.12 is single motor mode.
  Test steps:
  1. Let drive in remote mode and start monitoring trend.
  2. Give MCB close command and start command. Set a reference and wait for drive reaches the setpoint.
  3. Force DI2, drive will go to sync to main mode. After sync is finished. MSS will open and MB will close.
  4. Open MB.
- For multi motor mode
Make sure parameter 85.12 is multiple motors mode.

Test steps:
1. Let drive in remote mode and start monitoring trend.
2. Select motor, MSS will close.
3. Give MCB close command and start command. Set a reference and wait for drive reaches the setpoint.
4. Force DI2, drive will go to sync to main mode. After sync is finished. MSS will open and MB will close.
5. Open MB.
6. Test sync bypass of other motors.
7. Test other functions, for example, different motor types, different grids, Panel.

**Synchronization process**

The reading of a complete synchronization should look as follow.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>RSYC-01 board BUFOUT signal, for frequency / speed adjusting</td>
</tr>
<tr>
<td>Red</td>
<td>Motor frequency / speed</td>
</tr>
<tr>
<td>Green</td>
<td>RSYC-01 SYNC signal. Indicates two voltages are matching</td>
</tr>
<tr>
<td>Black</td>
<td>Par 85.02 SBU SW. 0x1043 -&gt; 0x1053 -&gt; 0x107B</td>
</tr>
</tbody>
</table>
**T1:** First time RSYC-01 SYNC signal is high, which means voltage frequency and phase angle of main and converter output are matching. RMS of voltage adjusting starts.

**T2:** Voltage amplitude matching is high, which means voltage amplitude of main and converter output are matching.

**T4:** Frequency and phase angle have been matching for more than 5 seconds, and also Voltage amplitude has been matching for more than 5 seconds. MB closes à Conver output current ramps down to zero à Drive stops modulation à MSS opens.

During synchronization, when the amplitude, frequency and phase angle of converter output voltage and grid voltage are within the limit, the converter output current is measured, and the converter is switched to current control. After MB closed feedback is received, current amplitude reference will ramp down to zero, and then converter stops modulation. After that MSS will open, and synchronization to grid is finished.

**SBU Current Control and Datalogger**

The tool to check behavior of SBU current controller is datalogger of DriveComposer. During every SBU commissioning, the Service Engineer should trigger a datalogger during synchronization as per below instructions.

- Instruction on using Dataloggers can be found in *Drive Composer manual* (3AUA0000094606).
• Please set the DL as per below example. Most important signals are 1.40, 1.41, 1.42, 85.2.

Note: A current controller is designed to limit the inrush current from grid when MB is closed, while its performance can be changed via tuning the SBU current gain parameter value. As a reference for tuning of the gain, the typical value of inrush current is around 1.2 times nominal value of drive output current. Note that the gain parameter (97.46) can be tuned in both directions to get the optimal setting.

Inrush current (p.u.) = (max motor current/ (converter nominal current * sqrt(2)))
The graph should be similar to the example below.

**Notice:** Please remember to attach the datalogger recording to the data uploaded to MoR.
- Observe and save the measurement, attach plot to report
Successful example for reference as below:

**Master/follower functionality**

- **Contents of this chapter**

  The master/follower functionality is usually used to link several drives together, so that the load can be evenly distributed between the drives. This is ideal in applications where the motors are coupled to each other via gearing, chain, belt, etc. This chapter introduces the parameter setting for master-follower control.

- **General**

  The master controls up to 10 followers by sending broadcast messages over fiber optic link via loop or star connection. The master can read feedback signals from up to 3 selected followers. Master is typically speed controlled.

  Follower is speed-controlled when the motor shafts of Master and the Follower drives are coupled flexibly so that a slight speed difference is possible. Drooping rate can be set to adjust speed dynamically for load balancing of master and followers.

  Follower is torque-controlled when the motor shafts of Master and the Follower drives are coupled solidly to each other.

  There are two kinds of Fault maybe occur during using M/F function. One is 7582 M/F comm loss and the other is FF7E Follower Fault.

  **ATTENTION:** The Master and Followers would be trip when these faults happen, but the master would not trip when non-surveillant Followers encounter these faults.

  7582 M/F comm loss shown with aux code on Master when Master communication loss with Follower, and it is shown without aux code on Follower when Follower communication loss with Master. This fault can be triggered when setting P60.9 M/F comm loss function to be “Fault” on both Master and Follower.
FF7E Follower Fault shown with aux code on Master when Follower has fault. (Aux code is the node of follower).

Make sure following items have been checked before M/F test.
1. All drives have been tested completely as vector control mode.
2. Check M/F link, and make sure the fiber optical connected properly.
3. Master/Follower options ticked in Converter configuration.

Vector control is the recommended control method for Master/Follower applications.
General parameter setting

Parameters setting in this section is just for your reference. The specific parameters should be set according to the user’s control requirements.
1. General configuration of Master

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Name</th>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.11</td>
<td>Ext1/Ext2 selection</td>
<td>Ext1</td>
<td></td>
</tr>
<tr>
<td>19.12</td>
<td>Ext1 control mode</td>
<td>Speed</td>
<td></td>
</tr>
<tr>
<td>60.1</td>
<td>M/F comm port</td>
<td>RDCO CH2</td>
<td>Channel of DDCS M/F</td>
</tr>
<tr>
<td>60.2</td>
<td>M/F node address</td>
<td>0 or 1</td>
<td></td>
</tr>
<tr>
<td>60.3</td>
<td>M/F mode</td>
<td>DDCS master</td>
<td></td>
</tr>
<tr>
<td>60.9</td>
<td>M/F comm loss function</td>
<td>Fault</td>
<td>Master’s action when comm loss happens</td>
</tr>
<tr>
<td>60.10</td>
<td>M/F ref1 type</td>
<td>Speed</td>
<td>Ref1 is used for speed control</td>
</tr>
<tr>
<td>60.11</td>
<td>M/F ref2 type</td>
<td>Torque</td>
<td>Ref2 is used for torque control</td>
</tr>
<tr>
<td>60.17</td>
<td>Follower fault action</td>
<td>Fault</td>
<td>Master’s action when Followers have fault</td>
</tr>
<tr>
<td>60.14</td>
<td>Follower nodes</td>
<td>User dependent</td>
<td>(optional) Master selects the Followers which need to be surveilled, and the related Follower node data sel need to be set (P62.4~10)</td>
</tr>
<tr>
<td>61.1</td>
<td>M/F data 1 selection</td>
<td>CW 16bit</td>
<td>Master selects the data which transmit to the Followers. The data value shown as P61.25~27</td>
</tr>
<tr>
<td>61.2</td>
<td>M/F data 2 selection</td>
<td>Other P23.2</td>
<td></td>
</tr>
<tr>
<td>61.3</td>
<td>M/F data 3 selection</td>
<td>Torque reference used</td>
<td></td>
</tr>
<tr>
<td>62.4</td>
<td>Follower node 2 data 1 sel</td>
<td>Follower SW</td>
<td></td>
</tr>
<tr>
<td>62.5</td>
<td>Follower node 2 data 2 sel</td>
<td>User dependent</td>
<td>(Optional) Master selects the data which receive from the Followers. The data value shown as P62.28~36</td>
</tr>
<tr>
<td>62.6</td>
<td>Follower node 2 data 3 sel</td>
<td>User dependent</td>
<td></td>
</tr>
<tr>
<td>62.7</td>
<td>Follower node 3 data 1 sel</td>
<td>Follower SW</td>
<td></td>
</tr>
<tr>
<td>62.8</td>
<td>Follower node 3 data 2 sel</td>
<td>User dependent</td>
<td></td>
</tr>
<tr>
<td>62.9</td>
<td>Follower node 3 data 3 sel</td>
<td>User dependent</td>
<td></td>
</tr>
<tr>
<td>62.10</td>
<td>Follower node 4 data 1 sel</td>
<td>Follower SW</td>
<td></td>
</tr>
<tr>
<td>62.11</td>
<td>Follower node 4 data 2 sel</td>
<td>User dependent</td>
<td></td>
</tr>
<tr>
<td>62.12</td>
<td>Follower node 4 data 3 sel</td>
<td>User dependent</td>
<td></td>
</tr>
<tr>
<td>25.8</td>
<td>Drooping rate</td>
<td>User dependent</td>
<td>Defines the droop rate (in percent of the motor nominal speed)</td>
</tr>
</tbody>
</table>

2. General configuration of Torque Follower

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Name</th>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.11</td>
<td>Ext1/Ext2 selection</td>
<td>Ext2</td>
<td></td>
</tr>
<tr>
<td>19.14</td>
<td>Ext2 control mode</td>
<td>Torque</td>
<td></td>
</tr>
</tbody>
</table>
3. General configuration of speed follower

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Name</th>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.11</td>
<td>Ext1/Ext2 selection</td>
<td>Ext2</td>
<td></td>
</tr>
<tr>
<td>19.14</td>
<td>Ext2 control mode</td>
<td>Speed</td>
<td></td>
</tr>
<tr>
<td>20.6</td>
<td>Ext2 commands</td>
<td>M/F link</td>
<td></td>
</tr>
<tr>
<td>20.7</td>
<td>Ext2 start trigger type</td>
<td>level</td>
<td></td>
</tr>
<tr>
<td>22.12</td>
<td>Speed ref2 source</td>
<td>M/F reference 1</td>
<td></td>
</tr>
<tr>
<td>60.1</td>
<td>M/F comm port</td>
<td>RDCO CH2</td>
<td>Channel of DDCS M/F</td>
</tr>
<tr>
<td>60.2</td>
<td>M/F node address</td>
<td>2 to 60</td>
<td>ID of this Follower</td>
</tr>
<tr>
<td>60.3</td>
<td>M/F mode</td>
<td>DDCS follower</td>
<td></td>
</tr>
<tr>
<td>60.9</td>
<td>M/F comm loss function</td>
<td>Fault</td>
<td>Follower’s action when comm loss happens</td>
</tr>
<tr>
<td>60.10</td>
<td>M/F ref1 type</td>
<td>Speed</td>
<td></td>
</tr>
<tr>
<td>62.1</td>
<td>M/F data 1 selection</td>
<td>CW 16bit</td>
<td>Follower selects the data which receive from the master. The data value shown as P62.25~27</td>
</tr>
<tr>
<td>62.2</td>
<td>M/F data 2 selection</td>
<td>Ref1 16bit</td>
<td></td>
</tr>
<tr>
<td>62.3</td>
<td>M/F data 3 selection</td>
<td>Ref2 16bit</td>
<td></td>
</tr>
<tr>
<td>61.1</td>
<td>M/F data 1 selection</td>
<td>SW 16bit</td>
<td>(Optional) Follower select the data which transmit to the master, and they are effective when this follower is selected by Master’s P60.14</td>
</tr>
<tr>
<td>61.2</td>
<td>M/F data 2 selection</td>
<td>User dependent</td>
<td></td>
</tr>
<tr>
<td>61.3</td>
<td>M/F data 3 selection</td>
<td>User dependent</td>
<td></td>
</tr>
</tbody>
</table>
Option

Configuration for switching master and follower

1. If choose one follower as forcing master, then this forcing master has high priority than old master (old master is not effective). Other followers will follow the forced master.

2. When Master is faulty, one Follower can be set to force master, then the other followers will follow the forced master.

3. Force master and follower can be change according to customer actual situations. But we only can change the roles when drives are not running.

Here is an example:
   a. Set BCU1 as master, BCU2 as follower running at speed mode, it follows master’s speed. BCU3 as follower running at torque mode, it follows master’s torque.
   b. Set BCU2 as master, BCU1 as follower run at speed mode, it follows master’s speed. BCU3 as follower run at torque mode, it follows master’s torque.

---

### ACS580MV Follower Parameter Settings — Speed Follower

<table>
<thead>
<tr>
<th></th>
<th>M/F data 1 selection</th>
<th>SW 16bit</th>
<th>(Optional) Follower select the data which transmit to the master, and they are effective when this follower is selected by Master’s P60.14</th>
</tr>
</thead>
<tbody>
<tr>
<td>61.1</td>
<td>M/F data 2 selection</td>
<td>User dependent</td>
<td></td>
</tr>
<tr>
<td>61.2</td>
<td>M/F data 3 selection</td>
<td>User dependent</td>
<td></td>
</tr>
<tr>
<td>25.8</td>
<td>Drooping rate</td>
<td>User dependent</td>
<td>The droop rate must be set for both the Master and the Follower</td>
</tr>
</tbody>
</table>

25.8 Drooping rate:
- User dependent
<table>
<thead>
<tr>
<th>Step</th>
<th>BCU1:</th>
<th>BCU2:</th>
<th>BCU3:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step1</td>
<td>20.01 Ext1 command = In1 start In2 Dir 20.06 Ext2 command = M/F link 22.11 Speed ref1 source = P47.1 22.12 Speed ref2 source = M/F reference 1 22.14 Speed ref1/2 selection = Follow Ext1/Ext2 selection 26.12 Torque ref2 source = M/F reference2 47.01 DataStorage 1 real32 = 150 60.01 M/F communication port = RDCO CH2 60.02 M/F node address = 1 60.03 M/F mode = DDCS forcing 60.08 M/F comm loss timeout = 10000 60.10 M/F ref1 type = Speed 60.11 M/F ref2 type = Torque 60.12 M/F act1 type = Speed 60.13 M/F act2 type = Torque 61.01 M/F data 1 selection = Follower CW 61.02 M/F data 2 selection = Used speed reference 61.03 M/F data 3 selection = Torque reference used 62.01 M/F data 1 selection = CW 16bit 62.02 M/F data 2 selection = Ref1 16bit 62.03 M/F data 3 selection = Ref2 16bit</td>
<td>20.01 Ext1 command = In1 start In2 Dir 20.06 Ext2 command = M/F link 22.11 Speed ref1 source = P47.1 22.12 Speed ref2 source = M/F reference 1 22.14 Speed ref1/2 selection = Follow Ext1/Ext2 selection 26.12 Torque ref2 source = M/F reference2 47.01 DataStorage 1 real32 = 300 60.01 M/F communication port = RDCO CH2 60.02 M/F node address = 2 60.03 M/F mode = DDCS forcing 60.08 M/F comm loss timeout = 10000 60.10 M/F ref1 type = Speed 60.11 M/F ref2 type = Torque 60.12 M/F act1 type = Speed 60.13 M/F act2 type = Torque 61.01 M/F data 1 selection = Follower CW 61.02 M/F data 2 selection = Used speed reference 61.03 M/F data 3 selection = Torque reference used 62.01 M/F data 1 selection = CW 16bit 62.02 M/F data 2 selection = Ref1 16bit 62.03 M/F data 3 selection = Ref2 16bit</td>
<td>20.01 Ext1 command = In1 start In2 Dir 20.06 Ext2 command = M/F link 22.11 Speed ref1 source = P47.1 22.12 Speed ref2 source = M/F reference 1 22.14 Speed ref1/2 selection = Follow Ext1/Ext2 selection 26.12 Torque ref2 source = M/F reference2 47.01 DataStorage 1 real32 = 300 60.01 M/F communication port = RDCO CH2 60.02 M/F node address = 3 60.03 M/F mode = DDCS forcing 60.08 M/F comm loss timeout = 10000 60.10 M/F ref1 type = Speed 60.11 M/F ref2 type = Torque 60.12 M/F act1 type = Speed 60.13 M/F act2 type = Torque 61.01 M/F data 1 selection = Follower CW 61.02 M/F data 2 selection = Used speed reference 61.03 M/F data 3 selection = Torque reference used 62.01 M/F data 1 selection = CW 16bit 62.02 M/F data 2 selection = Ref1 16bit 62.03 M/F data 3 selection = Ref2 16bit</td>
</tr>
<tr>
<td>Step2</td>
<td>60.15 Force master = True 19.11 Ext1/Ext2 selection = EXT1 19.12 Ext1 control mode = Speed</td>
<td>60.15 Force follower = True 19.11 Ext1/Ext2 selection = EXT1 19.14 Ext2 control mode = Speed</td>
<td>60.15 Force follower = True 19.11 Ext1/Ext2 selection = EXT2 19.14 Ext2 control mode = Torque</td>
</tr>
<tr>
<td>Step3</td>
<td>BCU1 is master 1.1 Motor speed used = 150 1.10 Motor torque = 10%</td>
<td>BCU2 is follower 3.13 M/F or D2D ref 1 = 150 3.14 M/F or D2D ref 2 = 10</td>
<td>BCU3 is follower 3.13 M/F or D2D ref 1 = 150 3.14 M/F or D2D ref 2 = 10</td>
</tr>
</tbody>
</table>
Remote connectivity

Contents of this chapter

This chapter describes the installation and commissioning of remote service products. For the drives with software version MHDRE v2.04.0.1 or higher, remote connection via NETA-21 is possible.

Make the drive ready

Hardware connection
Parameter setting
Activate XETH port for NETA-21 connection.

NETA-21 Setup
1. Download latest firmware and package to NETA-21 and login by using local Ethernet cable.
2. Set “BCU SD upload” to “Latest month” (Find it in Settings -> Device Interface -> Ethernet -> Settings).
3. Setup ETH1 port

4. Setup ETH2 port

NOTE: Settings in the picture is just an example, it works only for China domestic installation with 4G router.

5. Reboot NETA-21
Finalizing the connection

When NETA-21 is connected to network, 4 green ticks will appear on the home page of NETA-21.

Send detailed record list to Follow The Sun/Supportline:
Preventive Maintenance

Contents of this chapter

This section contains the maintenance schedule with recommended maintenance intervals and instructions of some special preventive maintenance items, which should be performed by qualified personnel.

WARNING Obey the instruction in Safety instructions of ACS580MV Hardware Manual (2UBB004520). If you ignore them, injury or death, or damage to the equipment can occur.

Maintenance schedule

The recommended intervals for maintenance and component replacement are based on the normal operating conditions of the drive. The drive should be checked at least every two years by qualified personnel whose recommendations should be followed. Depending on the actual condition of the drive, the maintenance work can be carried out before or after the recommended interval.

<table>
<thead>
<tr>
<th>Legend</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Inspection (visual inspection and maintenance action if required)</td>
</tr>
<tr>
<td>P</td>
<td>Performance of on-site work (commissioning, tests, measurements or other work)</td>
</tr>
<tr>
<td>R</td>
<td>Preventive replacement</td>
</tr>
</tbody>
</table>
### Regular inspection

The following table contains an overview of the most relevant inspection checks for the drive. ABB recommends that inspections be carried out whenever the drive has been shut down, i.e., to replace components or for any other field intervention.

<table>
<thead>
<tr>
<th>Inspection action</th>
<th>Interval [years]</th>
<th>Inspection Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter mats (replacement)</td>
<td>0.5¹</td>
<td>R</td>
</tr>
<tr>
<td>Power Module R1-R9</td>
<td>1</td>
<td>I or R</td>
</tr>
<tr>
<td>Transformer</td>
<td>1</td>
<td>I or R</td>
</tr>
<tr>
<td>Optical fibers</td>
<td>1</td>
<td>P</td>
</tr>
<tr>
<td>Cable connections, bolted connections</td>
<td>1</td>
<td>I</td>
</tr>
<tr>
<td>Dustiness, Corrosion and overheating</td>
<td>1</td>
<td>I</td>
</tr>
<tr>
<td>Software, hardware upgrades</td>
<td>2</td>
<td>I or P</td>
</tr>
<tr>
<td>Spare parts</td>
<td>2</td>
<td>P</td>
</tr>
<tr>
<td>Auxiliary voltage verification</td>
<td>1</td>
<td>I or P</td>
</tr>
<tr>
<td>Insulation test</td>
<td>4</td>
<td>P</td>
</tr>
<tr>
<td>Safety circuits</td>
<td>1</td>
<td>P</td>
</tr>
<tr>
<td>Isolator knife switch for Manual bypass</td>
<td>1</td>
<td>I or P</td>
</tr>
<tr>
<td>Contactor for auto bypass (Non ABB brand)</td>
<td>1</td>
<td>I or P</td>
</tr>
<tr>
<td>Contactor for auto bypass (ABB brand)</td>
<td>1</td>
<td>I or P</td>
</tr>
</tbody>
</table>

1 Inspection and replacement of filter mats depend on the ambient air quality, i.e. dustiness, humidity. Monthly filter inspection recommended, 3 months interval for filter replacement recommended.

### Preventive replacement schedule

The following table highlights the recommended replacement intervals for drive components, starting from the completion date of the commissioning².

<table>
<thead>
<tr>
<th>Years from commissioning</th>
<th>2</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling fans (no redundancy)</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling fans (redundant setup)</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Module R1-R9</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCBA, power supplies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control HW Batteries</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UPS batteries</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td></td>
<td></td>
<td>R</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

² The start date for the preventive replacement schedule is the commissioning completion date or 2 years after delivery, whichever comes first.
Insulation resistance measurement

- **Converter insulation resistance**

  Insulation resistance measurement for the converter, Please refer to *Converter Insulation Test*.

- **Transformer insulation resistance**

  If you just need to check the transformer insulation resistance, please refer to following procedure.

  1. Stop, de-energize and ground the drive following the steps in section *Shutting down the drive for maintenance* in *ACS580MV Hardware Manual* (2UBB004520) before you start the work.
  2. Disconnect all electrical connections between integrated transformer and drive, isolate the cables from ground or frames.
  3. Disconnect and earth all external electrical connections, including power, auxiliary, control, serial communication and ground cables. Ground the transformer cabinet.
  4. Short-circuit and ground the primary side of the transformer.
  5. Short-circuit and ground all auxiliary windings, heating cables and PT100.

  ![Measurement setup for transformer](image)

  6. Short-circuit and ground all secondary three-phase winding systems.
  7. Prepare the 5kV insulation resistance tester.
  8. Connect plus terminal to secondary phase A terminals, connect minus terminals to ground.
  10. Apply a test voltage of 5kV for 60 seconds.

  The insulation resistance value must >500MΩ in below test condition:
  - Ambient temperature in the range of 0 °C to 40 °C
  - Relative Humidity <70%

  11. Repeat steps 6 to 8 for other following three-winding systems:
      - Secondary phase B terminals
      - Secondary phase C terminals
      - Primary terminals
  12. When finished, remove all short-circuit connections and restore to the original state.
Motor insulation resistance

Insulation resistance measurement for motor, please refer to *Motor Insulation Test*.

Optical fibers

Visual check

Pay special attention to the following:

1. Cracks in the core or the coating.
2. Minimum bend radius (25 mm).
3. Condition of male and female connectors.
4. Installation across sharp edges.
5. Tightness of cable ties.

Attenuation measurement

1. Prepare the tools for attenuation measurement:
   - Tempo 253B light source (1)
   - Tempo 557B power meter (2)
   - 10ZP adapter
2. Unplug the optical fiber.
3. Check the ends of the optical fiber. If necessary, clean the fiber ends.
4. Connect the light source to one end and the power meter to the other end of the optical fiber.
5. Set the light source and the power meter to the appropriate wavelength:

<table>
<thead>
<tr>
<th></th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Light source</strong></td>
<td>660 nm, dBm, no modulation</td>
</tr>
<tr>
<td><strong>Power meter</strong></td>
<td>630 nm, dBm</td>
</tr>
</tbody>
</table>

6. Turn on the light source.
7. Measure the attenuation of the optical fiber.
8. Compare the measured values with below table:

<table>
<thead>
<tr>
<th>Value</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; -9 dBm</td>
<td>Perfect</td>
</tr>
<tr>
<td>&gt; -12 dBm</td>
<td>Acceptable</td>
</tr>
<tr>
<td>&lt; -12 dBm</td>
<td>Not acceptable</td>
</tr>
</tbody>
</table>

9. Replace the optical fibers with unacceptable attenuation.

**Communication test**

The communication test is to early detect communication problems by using parameters to control the POF link power between control Hub and Power Modules.

1. Charge the drive, set below two parameters to **Enable** to have the half power on Control Hub and PEBB TX POF link.
   - 95.55 Control hub half optical power
   - 95.70 PM half optical power
2. Observe the following parameters within 30 minutes:
   - 70.12/32/52..., Hub RX comm err count A1/A2/A3 ...
   - 71.12/32/52..., Hub RX comm err count B1/B2/B3 ...
   - 72.12/32/52..., Hub RX comm err count C1/C2/C3 ...
   - 70.5/25/45..., PM RX comm err count A1/A2/A3 ...
   - 71.5/25/45..., PM RX comm err count B1/B2/B3 ...
   - 72.5/25/45..., PM RX comm err count C1/C2/C3 ...
3. The observed RX comm err counters can have an initial value which may different from 0, but DO NOT have variation.
4. If any counter variation happens during this test, or “Control hub missing PM” fault occurs, do as following steps:
   - Check/replace the POF link between the Control Hub and PEBB, repeat the communication test.
   - In case last step doesn’t solve the problem, replace Control Hub daughter board which connected to the failed communication link, repeat the communication test.
5. Set parameters 95.55 and 95.70 back to **Disable** after this test passed.
## Bypass unit

### Isolation switches for Manual Bypass

Pay special attention to the following:

1. The isolation switches should be easy for operation.
2. Conductive grease like “OKS VP980” is applied on contact surface of isolation switches, apply more if necessary.
3. No loose connection.
4. Check status lamps on front door by operating isolation switches.
5. Check interlock of isolation switches as the table below.

<table>
<thead>
<tr>
<th>Switches status</th>
<th>Selector in &quot;Change&quot; position</th>
</tr>
</thead>
<tbody>
<tr>
<td>QS1 (Q1) open</td>
<td>close QS1 (Q1) (✓)</td>
</tr>
<tr>
<td>QS2 (Q2) open</td>
<td>close QS2 (Q2) (X) OR close QS3 (Q3) (X)</td>
</tr>
<tr>
<td>QS3 (Q3) open</td>
<td>close QS3 (Q3) (✓)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Switches status</th>
<th>Selector in &quot;Change&quot; position</th>
</tr>
</thead>
<tbody>
<tr>
<td>QS1 (Q1) close</td>
<td>open QS1 (Q1) (X) OR open QS2 (Q2) (X)</td>
</tr>
<tr>
<td>QS2 (Q2) open</td>
<td>close QS2 (Q2) (✓)</td>
</tr>
<tr>
<td>QS3 (Q3) open</td>
<td>close QS3 (Q3) (X)</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Switches status</th>
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<tr>
<td>QS1 (Q1) close</td>
<td>open QS1 (Q1) (X)</td>
</tr>
<tr>
<td>QS2 (Q2) close</td>
<td>open QS2 (Q2) (✓)</td>
</tr>
<tr>
<td>QS3 (Q3) open</td>
<td>close QS3 (Q3) (X)</td>
</tr>
</tbody>
</table>

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<tr>
<td>QS1 (Q1) open</td>
<td>close QS1 (Q1) (X)</td>
</tr>
<tr>
<td>QS2 (Q2) open</td>
<td>close QS2 (Q2) (X)</td>
</tr>
<tr>
<td>QS3 (Q3) close</td>
<td>open QS3 (Q3) (✓)</td>
</tr>
</tbody>
</table>

**Note:**
- “X” means the operation cannot be executed.
- “✓” means the operation can be executed.
- Any of switches cannot be operated when the selector is in “Operation” or “OFF” position.

### Contactor for Auto Bypass

Pay special attention to the following:
1. Overall impression: no damage, and firmly mounted.
2. Connection points: no overheating, corrosion or rustiness.
3. Mechanical latch: no damage, deformation or rustiness.
4. Auxiliary contacts: no corrosion; moving contacts acts easily after pressing connection-rod.
5. Check interlock of isolator knife switches as below table:

<table>
<thead>
<tr>
<th>Contactors status</th>
<th>Selector in &quot;Local&quot;/&quot;Remote&quot; position</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM1 (Q1) open, KM2 (Q2) open, KM3 (Q3) open</td>
<td>close KM1 (Q1) (✓) OR close KM3 (Q3) (✓)</td>
</tr>
<tr>
<td>KM1 (Q1) close, KM2 (Q2) open, KM3 (Q3) open</td>
<td>open KM1 (Q1) (X) OR close KM2 (Q2) (X)</td>
</tr>
<tr>
<td>KM1 (Q1) close, KM2 (Q2) close, KM3 (Q3) open</td>
<td>open KM1 (Q1) (✓) OR close KM3 (Q3) (✓)</td>
</tr>
<tr>
<td>KM1 (Q1) open, KM2 (Q2) open, KM3 (Q3) close</td>
<td>close KM1 (Q1) (X) OR open KM3 (Q3) (✓)</td>
</tr>
</tbody>
</table>
Further information

Product and service inquiries
Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to abb.com/searchchannels.

Product training
For information on ABB product training, navigate to new.abb.com/service/training.

Providing feedback on ABB Drives manuals
Your comments on our manuals are welcome. Navigate to new.abb.com/drives/manuals-feedback-form.

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