INSTRUCTION MANUAL

VORTEX FLOWMETERS
50VM1000 Design Level A
FIRMWARE A.31

50VM1000A Vortex 4™ FLOW COMPUTER

PN24619

The following are trademarks of ABB Inc.: **Vortex 4™**

The following is a registered trademark of Rosemount Incorporated: **HART®**

WARNING notices as used in this manual apply to hazards or unsafe practices which could result in personal injury or death.

CAUTION notices apply to hazards or unsafe practices which could result in property damage.

NOTES highlight procedures and contain information which assist the operator in understanding the information contained in this manual.

WARNING
INSTRUCTION MANUALS
Do not install, maintain or operate this equipment without reading, understanding and following the proper ABB Inc. instructions and manuals, otherwise injury or damage may result.

POSSIBLE PROCESS UPSETS
Operation & maintenance must be performed only by qualified personnel and only after securing equipment controlled by this product. Adjusting or removing this product while it is in the system may upset the process being controlled. Some process upsets may cause injury or damage.

Table of Contents

Figure List

Table List

READ FIRST

WARNING

All Flowmeters and/or Flow Computers being returned to ABB Inc. must be free of any hazardous materials (acids, alkalis, solvents, etc.). A Material Safety Data Sheet (MSDS) for all process liquids must accompany returned equipment. Contact ABB Inc. for authorization prior to returning equipment.

Read these instructions before starting installation;
save these instructions for future reference.

1.0 INTRODUCTION

1.1 Description

The ABB 50VM1000 Flow Computer and its associated flowmeter are designed to operate as companion instruments. The basic metering system consists of a pipe mounted Flowmeter (Model 10VM1000) and a Flow Computer (Model 50VM1000). Information provided in this Bulletin is applicable to the 50VM1000 Flow Computer. For information applicable to the 10VM1000 Flowmeter refer to Instruction Bulletin 10VM1000.

The 50VM1000 Flow Computer is of modular construction using surface mounted technology. As the primary design criteria for this instrument required that a high level of performance and maximum life expectancy be given foremost priority, only premium quality components are used in the printed circuits.

The flowmeter is a volumetric flow measuring device that generates a given number of pulses per unit volume of fluid that passes through the meter. As the vortex system can be used in liquid, gas and steam applications, any one of a number of engineering measurement units can be selected for meter operation. Engineering units listed in Table 3-2 can be selected.

The meter can be either dry or wet calibrated, depending on the type of calibration specified at the time of purchase. In either case the meter calibration, K, will be given in pulses/actual cubic meters at the specified operating. The frequency of the digital output signal will vary in direct proportion to flow rate and because each pulse transmitted represents a discrete measurement increment, the signal pulses can be integrated to provide an accurate record of the cumulative delivered volume.

Example:

Total Flow = Total Count / K

1.1.1 Principle of Operation

In operation, as the incoming fluid is divided past the shedder bar, vortices are successively detached and appear alternately on either side of the sensor in the form of fluidic perturbations. As the vortices move downstream from the shedder bar, they produce an alternating pattern referred to as a Karman vortex street. Over the range of Reynolds numbers corresponding to the instrument range, the frequency of vortex formation is directly proportional to flow velocity and can be stated as shown in the following equation.

where:

f = vortex frequency
V = inlet velocity
d = width of shedder bar
St = Strouhal number (constant over the range specified in the sizing tables in the 10VM1000 Instruction Bulletin)

$$f = \frac{V}{d} \bullet St$$

1.2 Model Number Breakdown

Refer to the data sheet or the equipment tag for the model number of the equipment. The definition of a specific model number is as follows:

	50VM	_	_	_	**A**	_	_	_	_	_	**2**

Engineering Reference

Pulse Output

Active 24 VDC	1
Passive, Relay Contact	2
Passive, Optocoupler	3

Serial Interface

None	0
RS485	1
RS232	2

Certification

None (General Purpose Non-Hazardous Locations)	0
Nonincendive (CLI, Div.2, Groups A-D)	1

Design Level

	A

Enclosure

Field Mount Without Window	B
Field Mount With Window	C

Contact Outputs

None	0
Passive, Optocoupler	
Passive, Relay Contact	

Alarms

None	A
Limit Alarms, Min/Max	B
Limit Alarms, Max Only	C

Optional Features

None	A
Pressure/Temperature Compensation	B
HART Protocol	C
Pressure/Temperature and HART Protocol	D

Power Supply

230 VAC	A
115 VAC	B
48 VAC	C
24 VAC	D
48 VDC	E
24 VDC	F

Language

English	2

1.3 Specifications

Standard Programs	Pressure and temperature compensation of gases or steam, density correction of liquids using temperature input, heat flow calculations, compressibility factor compensation in gases and a 7 point linearization curve for flow inputs.
Inputs	Flowmeter: Frequency Temperature: 2, 3, or 4 wire RTD Pressure: 0/4-20 mA External counter reset External output switch
Outputs	4-20 mA current output and square wave frequency output proportional to sensed vortex frequency for diagnostic purposes (refer to Figure 2-2, Note 4). Active opto relay pulse output: 24 V dc ≥150Ω RS232/RS485 serial interface Min/Max opto relay alarms: 250 mA at 28 V dc Optional HART Protocol
Power Supply	115-230 V ac (± 15%) 50/60 Hz 24/48 V ac 24/48 V dc
Flow Computer:	
Remote	Diecast aluminum with epoxy paint NEMA 4 (IEC 529 IP65)
Ambient Temperature	–10 to 140^{o} F (–25 to 60^{o} C)
Relative Humidity	10 to 90% (non-condensing)
Certifications	FM approved Nonincendive for Class I, Div. 2 Groups A-D
Display	2 line, 16 character LCD standard

Communications

Optional HART Protocol communication link superimposed on standard 2 wire 4 - 20 mA process signal.

The HART Protocol provides for digital communications between a process control system PC, hand held terminal and the Vortex meter. All values, such as input parameters, can be downloaded to the process control system or PC. In reverse, programming of a new configuration can be accomplished in a similar manner.
The digital communication occurs through the use of an alternating voltage superimposed on the current output (4-20 mA) which does not effect any of the other instruments connected to the output signal.

Transmission Type: Frequency Shift Keying (FSK) modulation on the 4-20 mA current output in accordance with the Bell 202 standard. Max. signal amplitude 1.4 V p-p.

Logic 1: 1200 Hz
Logic 0: 2200 Hz

Current Output Load: Min. > 250 Ω, Max. < 750 Ω

Max. cable length: 2600 ft (800 m) 24 AWG

Baud rate: 1200

2.0 INSTALLATION

2.1 Inspection

The equipment should be inspected for damage that may have occurred during shipment. All damage should be reported to the shipping agent. If the equipment is damaged to the extent that faulty operation may result, contact ABB Inc. before installation. Always reference the complete instrument serial number and model number in all correspondence concerning the equipment supplied.

2.2 Location and Mounting

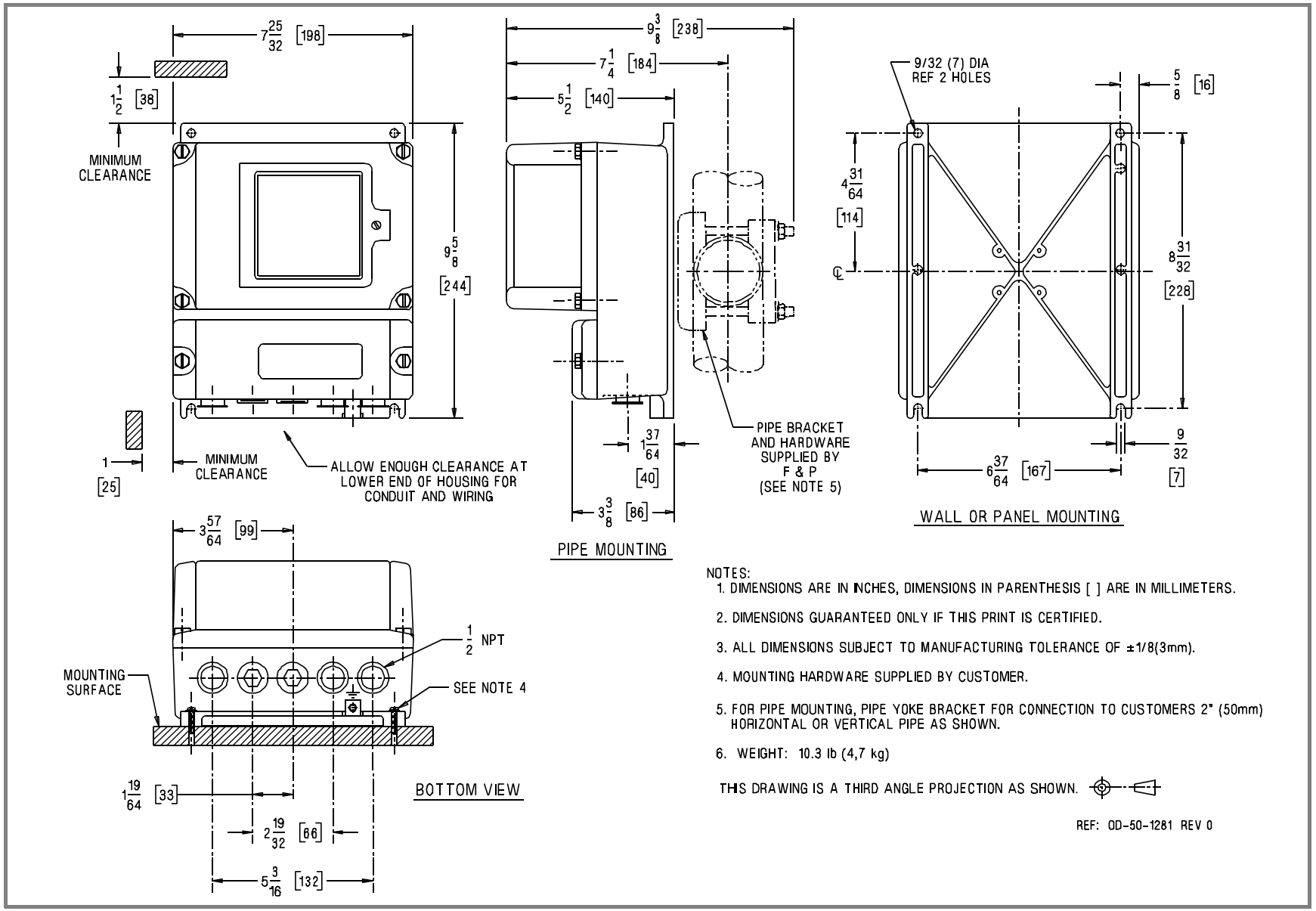
WARNING
Equipment powered by ac line voltage constitutes a potentially lethal electric shock hazard. Installation and servicing of the equipment should only be attempted by a qualified technician.
Make certain that the power input leads are disconnected from the operating branch circuit before attempting electrical connections.

The remotely mounted flow computer may be located up to 2600 feet (800 m) from the flowmeter. Use of NEC type CMR, 22 AWG minimum (Belden 9363 or equivalent) signal cable is acceptable for most applications. However, for process temperatures above 221^{o} F (105^{o} C) and plenum service, use NEC type CMP (Belden 83553 or equivalent). Interconnection cable is the responsibility of the user. Conduit seals are required at all cable entrances.

The installation site for the remotely mounted flow computer should be clean, well lighted and adequately ventilated. Repair and maintenance of the equipment should be considered when selecting an installation site. The remotely mounted enclosure is designed to meet NEMA 4 standards and is suitable for indoor or outdoor installation in an environment that is within the temperature and humidity limits as given in Section 1.3. The remote enclosure should be mounted in a vertical position with the 1/2 inch NPT conduit openings on the bottom. **All unused conduit entrances must have pipe plugs installed.** This is required to maintain the NEMA 4 rating. Mounting hardware for wall mounting is supplied by the user.

An alternative mounting option permits the remote enclosure housing to be mounted to a 2-inch horizontal or vertical pipe. The pipe clamping brackets and mounting hardware are supplied by ABB. Insert the two 5/16-18 x 3-3/4 inch bolts into the holes provided in the pipe mounting bracket. Orient the bracket as required for vertical or horizontal pipe. As shown in Figure 2-1, this pipe mounting bracket must be attached to the rear of the enclosure. Four 1/4-20 x 1/2 inch selftapping screws are supplied with the pipe mounting kit for attaching the bracket. To mount the enclosure, place the housing with the attached bracket against the mounting pipe with the pipe between the two 3-3/4 inch bolts. While supporting the housing, install the pipe clamping bracket, flat washers and hex nuts. Tighten the nuts alternately to maintain even pressure distribution across the clamping bracket. Check that the enclosure housing is plumb before securing.

Outline and mounting dimensions for the remotely mounted enclosure are provided in Figure 2-1.



NOTES:

1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN PARENTHESIS [ ] ARE IN MILLIMETERS.
2. DIMENSIONS GUARANTEED ONLY IF THIS PRINT IS CERTIFIED.
3. ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCE OF ±1/8(3mm).
4. MOUNTING HARDWARE SUPPLIED BY CUSTOMER.
5. FOR PIPE MOUNTING, PIPE YOKE BRACKET FOR CONNECTION TO CUSTOMERS 2" (50mm) HORIZONTAL OR VERTICAL PIPE AS SHOWN.
6. WEIGHT: 10.3 lb (4,7 kg)

THIS DRAWING IS A THIRD ANGLE PROJECTION AS SHOWN.

REF: OD-50-1281 REV 0

FIGURE 2-1. FLOW COMPUTER OUTLINE AND MOUNTING DIMENSIONS

2.3 Electrical Interconnections and Grounding

WARNING
Equipment powered by ac line voltage constitutes a potentially lethal electric shock hazard. Installation and servicing of the equipment should only be attempted by a qualified technician.
Make certain that the power input leads are disconnected from the operating branch circuit before attempting electrical connections.

The installation site must be provided with a source of power that is compatible with the flow computer power requirements. Refer to the instrument tag for power requirements.

The housing covers are removable for servicing during installation and maintenance. Remove the covers from the housing by loosening the screws on the covers. Replace the covers when the installation has been completed and **before power is applied to the equipment.**

The flow computer customer connection box is supplied with five openings for conduit fittings. **Any unused opening must be sealed by installing a pipe plug in each unused opening. This is required to maintain the NEMA 4X rating of the enclosure.**

Certain terminal assignments vary in accordance with the model number as defined in the terminal assignment table in Figure 2-2. Note that the terminals labeled V1 through V4 are used for the active pulse output as well as the data link. Consequently, only one of these can be selected as an option. If a pulse output is required as well as the data link, the output pulse is available on terminals V12 and V13.

Unless otherwise specified, thirty feet of signal and ground cable is supplied by ABB for connecting the flowmeter process signal to the remotely mounted flow computer. The flowmeter housing ground terminal is connected to the signal converter housing ground terminal, which is connected to an external earth ground. Refer to the flowmeter grounding procedure given in the instruction bulletin provided for the flowmeter.

Refer to Figure 2-2 for interconnection wiring and grounding.

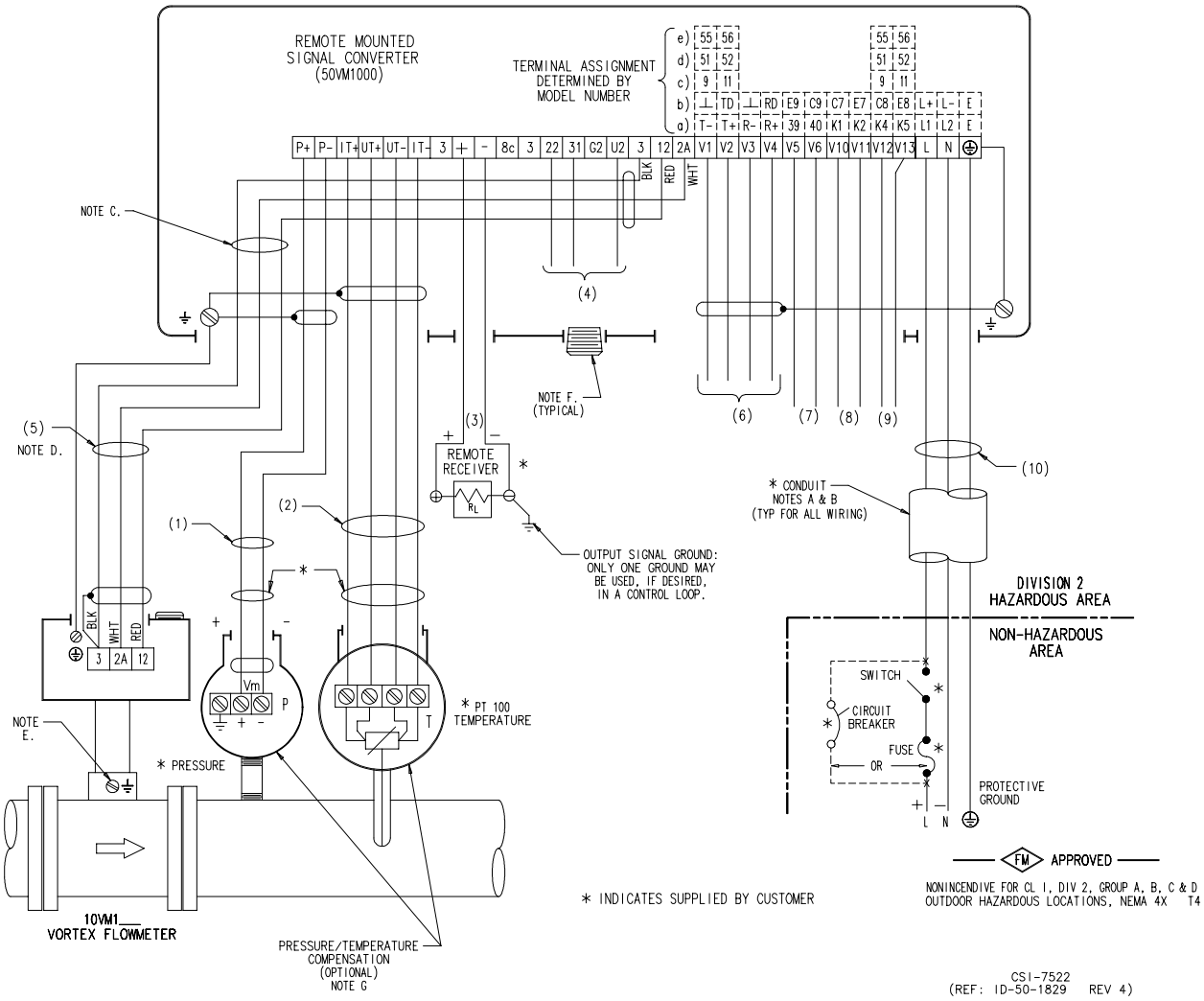


FIGURE 2-2. INTERCONNECTION WIRING DIAGRAM

(Refer to the following page for applicable text.)

INSTALLATION NOTES

A. EQUIPMENT AND WIRING TO BE INSTALLED IN ACCORDANCE WITH ANSI/NFPA 70 (NATIONAL ELECTRICAL CODE) AND LOCAL CODE REQUIREMENTS.

B. HAZARDOUS LOCATIONS: WIRING TO BE IN CONDUIT, BOXES, FITTINGS AND SEALS TO COMPLY WITH ARTICLE 501 OF ANSI/NFPA 70 AND LOCAL ELECTRICAL CODE REQUIREMENTS.

C. SHIELDED CABLE IS REQUIRED. THE UNTERMINATED END OF THE SHIELD SHALL BE INSULATED FROM THE CONVERTER.

D. USE NEC TYPE CMR, 22 AWG MINIMUM (BELDEN 9363 OR EQUIVALENT). FOR PROCESS TEMPERATURES GREATER THAN 105°C AND PLENUM SERVICE, USE NEC TYPE CMP (BELDEN 83553 OR EQUIVALENT).

E. BODY OF VORTEX FLOWMETER SHALL BE GROUNDED THROUGH THE PIPELINE FLANGES OR THROUGH THE VORTEX METER EXTERNAL GROUND TERMINAL.

F. SEALS REQUIRED AT UNUSED CONDUIT ENTRIES TO MAINTAIN NEMA 4X ENCLOSURE RATINGS.

G. APPROVAL DOES NOT INCLUDE OPTIONAL PRESSURE TRANSDUCER AND PT100 TEMPERATURE SENSOR. THESE COMPONENTS ARE SUPPLIED BY THE END USER AND MUST BE APPROVED BY FMRC FOR THE SPECIFIC HAZARDOUS LOCATION.

TERMINAL ASSIGNMENT TABLE

(1) PRESSURE INPUT (CURRENT): MAXIMUM LENGTH 2600ft (800m)
PRESSURE SENSOR 0/4-20mA; P+ = 30 V.

(2) TEMPERATURE INPUT: MAXIMUM LENGTH 2600ft (800m)
Pt100 - RESISTANCE, IP = 1mA; VP = 19,5 - 247mV FOR -328 TO +752°F(-200 TO +400 °C)

(3) CURRENT OUTPUT: MAXIMUM LENGTH 4900ft (1500m)
SELECTABLE; LOAD ≤750 OHMS, 0-20mA, 4-20mA, 0-10mA, 2-10mA

(4) 22/U2: EXTERNAL ZERO RETURN, PASSIVE CONTACT CLOSURE
31/U2: EXTERNAL TOTALIZER RESET, PASSIVE CONTACT CLOSURE, BOTH INPUTS OPTOCOUPLER ISOLATED

(5) SIGNAL CABLE: (CONNECT SHIELD ONLY AT PREAMPLIFIER) MAXIMUM LENGTH 2600ft (800m)

(6) DATA LINK OR PULSE OUTPUT:
a) DATA LINK RS 485; MAXIMUM LENGTH 3940ft (1200m)
b) DATA LINK RS 232C/24V; MAXIMUM LENGTH 50ft (15m)
c) SCALED PULSE OUTPUT, ACTIVE, 24Vdc, LOAD ≥150 OHMS
d) SCALED PULSE OUTPUT, PASSIVE, RELAY CONTACT CLOSURE, ≤120mA, ≤30Vdc
e) SCALED PULSE OUTPUT, OPTOCOUPLER, 5V ≤V_{CE} ≤25V, 5mA ≤I_{CE} ≤30mA

NOTE: A SHIELDED DATA CABLE IS RECOMMENDED FOR USE WITH THE RS 232C DATA LINK; A SHIELDED CABLE WITH INDIVIDUALLY TWISTED PAIRS IS RECOMMENDED FOR USE WITH THE RS 485 DATA LINK.

(7) ALARM CONTACT, OPENS IN ALARM CONDITION
a) ALARM CONTACT, RELAY, ≤120mA, ≤30Vdc
b) ALARM OUTPUT, OPTOCOUPLER, V_{CE} ≤25V, I_{CE} ≤7.5mA

(8) MAX-ALARM
a) ALARM CONTACT, RELAY, OPENS, ≤120mA, ≤30Vdc
b) ALARM OUTPUT, OPTOCOUPLER, V_{CE} ≤25V, I_{CE} ≤7.5mA

(9) PULSE OUTPUT OR MIN-ALARM
a) ALARM CONTACT, RELAY, OPENS, ≤120mA, ≤30Vdc
b) ALARM OUTPUT, OPTOCOUPLER, V_{CE} ≤25V, I_{CE} ≤7.5mA
c) SCALED PULSE OUTPUT, ACTIVE, 24Vdc, LOAD ≥150 OHMS
d) SCALED PULSE OUTPUT, PASSIVE, RELAY CONTACT CLOSURE, ≤120mA, ≤30Vdc
e) SCALED PULSE OUTPUT, OPTOCOUPLER,5V ≤V_{CE} ≤25V, 5mA ≤I_{CE} ≤30mA

(10) POWER SUPPLY (SEE DATA TAG): a) AC 50/60Hz b) LOW VOLTAGE AC 50/60Hz c)DC

(11) TERMINALS V1 & V2, V3 & V4, V5 & V6, V10 & V11, V12 & V13 ARE APPROVED WITH NON-INCENDIVE FIELD PARAMETERS AS FOLLOWS:

V_{max} = 30 V C_i = 0 uF

I_{max} = 120 mA L_i = 0 mH

(12) THE POWER SOURCE CONNECTED TO TERMINALS V1 & V2, V3 & V4, V5 & V6, V10 & V11, V12 & V13 MUST BE FMRC APPROVED WITH NON-INCENDIVE FIELD CIRCUITS SPECIFYING V_{oc}, I_{sc}, C_a AND L_a. ALL OTHER I/O ARE TERMINALS TO BE IN ACCORDANCE WITH ANSI/NFPA 70 (NATIONAL ELECTRICAL CODE).

CSI-7523
(REF ID-50-1829 REV 4)

FIGURE 2-2. INTERCONNECTION WIRING DIAGRAM

(Refer to the previous page for applicable diagram.)

3.0 START-UP AND OPERATION

WARNING
Equipment powered by ac line voltage constitutes a potentially lethal electric shock hazard. Installation and servicing of the Flow Computer should only be attempted by a qualified technician.
Make certain that the power input leads are disconnected from the operating branch circuit before attempting electrical connections.

3.1 Start-Up

Prior to initial system start-up, verify that the meter is properly installed. Check flow direction as indicated on the meter body and wiring interconnections as discussed in the Installation Section 2.0.

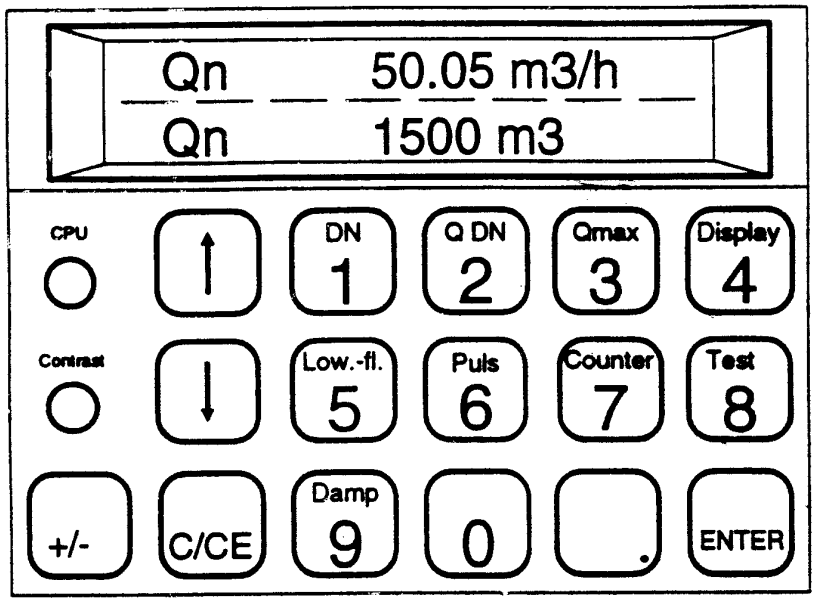
Verify that the power supply is compatible with the power requirements of the equipment.

Using the keypad on the flow computer, verify that the operating parameters have been correctly entered. Operating parameters are entered by ABB if specified at time of order. Changing or entering parameters is described in the following Sub-Sections.

Initiate process flow through the flowmeter. Flow measurement and output signal transmission will commence with flow through the flowmeter.

3.2 Keypad and Display

Key functions are defined in Sub-Section 3.3.



SI-7521

3.3 Keypad Functions

The keypad includes some keys that perform dual functions. A dual function key is labelled with the (abbreviated) name of a parameter and a numeral. A dual function key:

- can be used to directly access the parameter named on the key
- once a parameter is displayed, a dual function key can be used when keying-in a numeric value as described in Sub-Section 3.8

For example, the key labelled [DAMP 9] can be used to call up the damping parameter without cycling through the configuration menus. Once any parameter is on display (and the ENTER key has been pressed as described in Sub-Section 3.8), pressing the key will key-in the number 9. All parameters are described later in this section. The Sub-Sections describing the parameters accessed with the dual function keys are shown in parentheses.

↑	Parameter selection forward	Test 8	Self check sub menu (3.39) number 8
↓	Parameter selection reverse	Damp 9	Damping (3.31) number 9
DN 1	DN=meter size (3.16) number 1	0	Load data from ext. EEPROM (3.41.2) Zero
Q DN 2	Q DN=Meter Range Max (3.26) number 2	•	Store data in ext. EEPROM (3.41.1) Decimal Point
Q max F 3	QmaxF=Range Max (3.27) number 3	ENTER	1. Change program protection (3.12) 2. Enter new values
Display 4	Display sub menu (3.33) number 4	C/CE	1. Toggle between monitor and configuration modes 2. Cancels incorrect entry
Low-f 5	Low-f=Range Min (3.28) number 5	+/-	+/- Sign
Puls 6	Pulse output sub menu (3.30) number 6	◯	Contrast: Adjust display contrast
Counter 7	Totalizer sub menu (3.29) number 7	◯	CPU diode will blink if a malfunction occurs

3.4 C/CE Key

When the C/CE key is pressed while the unit is in monitoring mode, the flowrate and totalization in the display will be replaced by a data base parameter. The name of the parameter will appear on the top line, and the changeable value on the bottom line. If no entries or changes are made within 20 seconds the unit will automatically revert to the monitoring mode.

If an incorrect value is keyed-in, press the C/CE key to clear the entry. The incorrect value will be cleared and the previous value will appear in the display. If the C/CE key is pressed again the display will return to the monitor mode.

3.5 Display

The standard display (monitoring mode) will appear after the flow computer is powered and completed the self test routine.

The indication of the flowrate and value in the first 2 lines indicates the flow type (see 3.33.2 and 3.33.4).

Qv = Actual volumetric flow units
Qn = Normal volumetric flow units (normal conditions: 1013 m_{bar}, 0^{o} C) (14.7 psia, 32^{o} F)
Qm = Mass flow units

Qv 25.4 gal^3/h Qn 1545 gal^3

The direct access keys can be used to exit from the monitoring mode to the configuration mode.

Sub Menu Display

The arrow keys can be used to select the individual menus and sub menus. For example:

1. Line Qv Actual

In an error condition the first line of the display in monitor mode indicates the error code.

Error - 2 Qv 1545 gal^3

Preamplifier Qv 1545 gal^3

This message toggles between a text message and the error code. The error code indication lists all the failures which have been detected.

3.6 Error Messages

Error messages replace the flow rate indication on the top line of the display when certain failure conditions exist or when an unacceptable value has been entered. Refer to Table 3-1 for explanation of error messages. Refer to 3.40.1 for error register information and 3.43.2 for error reset to clear a message from the display.

TABLE 3-1. EXPLANATION OF ERROR MESSAGES

Error Code	Description	Cause
0	Steam Calculation	Incorrect menu values for saturated or superheated steam selection.
2	Preamplifier	No signal from preamplifier.
3 (a)	Flowrate > 115%	Flowrate is greater than 115% of range maximum.
4	Ext. Zero Return	External zero return activated.
5 (b)	EEPROM Defect	Data error in EEPROM.
6	Totalizer Error	Totalizer value is invalid.
7	Pressure	No signal from pressure sensor.
8	Temperature	No signal from temperature sensor.
9 (c)	Qv >115% Qmax DN	Flowrate greater than 115% of meter range max.

(a) Self-resetting alarm condition. Normal operation resumes when alarm condition clears.
(b) Refer to Sub-Section 3.43.3.
(c) This alarm condition forces the output current to its alarm value of 115% of maximum flowrate and to "latch" there. It is not self-resetting. When the alarm condition has cleared, the meter may be reset by pressing any button on the keypad. Code 9 can be disabled per Sub-Section 3.43.7.

3.7 Parameter Entries

There are two ways to make changes to the data base. One is by entering a **numeric** value using the keypad, the other by making a **menu** selection from the menu. Instructions for making the two types of entries are described in Sub-Sections 3.8 and 3.9. Parameters are described in Sub Sections 3.11 through 3.43.

3.8 Numerical Entries

1) Select the desired parameter by actuating the appropriate key i.e., directly using the double function keys or by using the ARROW keys and the firmware menus. Displayed on the first line is the parameter and on the second line the value of the parameter.

2) Press the ENTER key. The text displayed in the first line remains while the value in the second line is erased and replaced with the cursor which indicates the readiness to accept input from the keypad. If no values are entered the original value reappears after approximately 20 seconds and the monitor mode display reappears.

3) Data input begins at the most significant digit. Pressing the ENTER key enters the data in the converter memory. The new value is displayed in the indicator.

If an incorrect value is keyed-in, press the C/CE key to clear the entry. The incorrect value will be cleared and the previous value will appear in the display. To return to the monitoring mode press the C/CE key again.

The flow computer checks the correctness of the input value. If the value is outside the acceptable range an error message is displayed and the previous data values are retained. The message can be cleared by pressing the C/CE key or the ENTER key which will display the previous value.

3.9 Menu Entries

Menu entries are made using the arrow keys to select a value from a menu. The selected value is entered using the ENTER key.

3.10 Units of Measure

The following table defines the abbreviations used in the applicable menu selections.

TABLE 3-2. UNITS OF MEASURE

Abbreviations	Definitions
ugl	US gallons
igl	Imperial gallons
bbl	barrels (42 gallons)
l	liters
ml	milliliters
m^3	cubic meters
cm^3	cubic centimeters
ft^3	cubic feet
kg	kilograms
t	metric tons
lb	pounds
g	grams

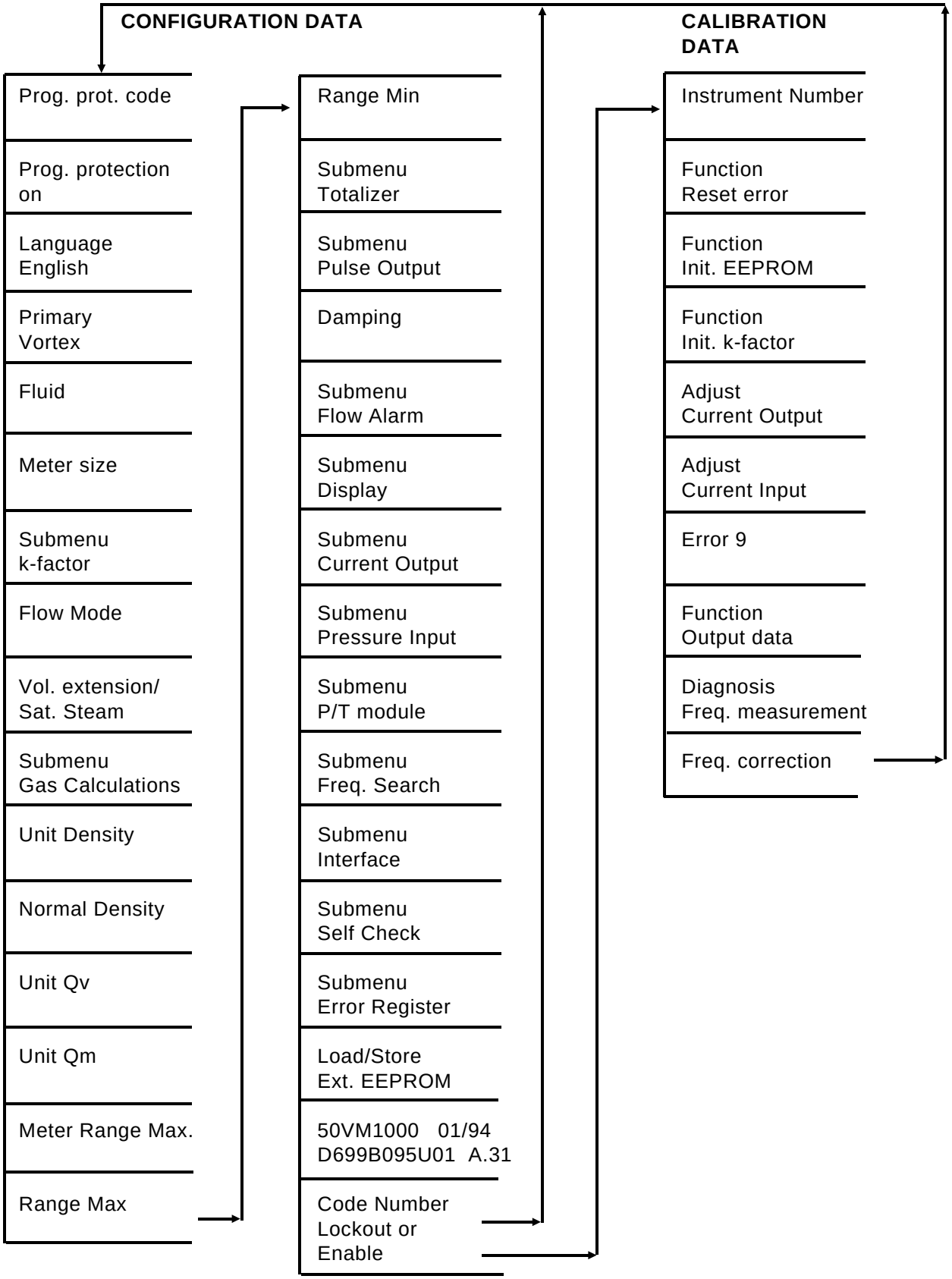


FIGURE 3-1. FLOWCHART OF PARAMETERS

3.11 Firmware Version

The firmware level and the model number are shown in the display with the model number and firmware release date on the top line, and the EPROM identification and firmware level on the bottom line. Changes to the firmware can only be made by replacing the EPROM. When communicating with ABB, reference the firmware version (A.31) of the instrument.

NOTE
This procedure has been prepared based on firmware version A.31. Other versions will be similar, but not identical and may have features different from those discussed in this section.

```
50VM1000       01/94
D699B095U01    A.31
```

3.12 Program Protection Code

The Program Protection is automatically turned **ON** during power-up. Parameters **cannot** be changed when Program Protection is **ON**. Parameters can be displayed when Program Protection is **ON** using the arrow keys. If an attempt is made to change parameters with program protection **ON** the following will appear.

```
Error
Program protection
```

When the correct program protection code is entered the program protection is turned **OFF** by pressing **ENTER**. Program protection remains **ON** if an incorrect protection code number is entered.

Program protection can automatically be turned **OFF** by entering the Code Number as described in Sub-Section 3.43.

Program protection can be turned **ON** by pressing **ENTER**. However, this automatically deactivates the Code Number and prevents access to the calibration parameters (refer to Sub-Section 3.43).

```
Prog Protection
```

Menu Choices:

On
Off

If the program protection code is other than **0** (1 to 9999) it is requested when attempting to turn the program protection off.

To change a program protection code number first enter the Code Number as described in Sub-Section 3.43 and press enter, the old program protection code will appear on the display.

```
Old PP-code ?
_
```

Press enter. Then enter the new number using the number keys.

```
New PP-code ?
_
```

The new number will be displayed to assure correct entry. Asterisks (****) will appear on the display if program protection is **ON**.

3.13 Language

English entered by ABB.

```
Language
English
```

Menu Choices:

English
German

3.14 Primary

Vortex entered by ABB.

```
Primary
Vortex
```

Menu choices:

Vortex
Swirlmeter

3.15 Fluid

Select the appropriate process fluid.

Fluid

Menu Choices:

Liquid
Superheated Steam
Saturated Steam
Gas

3.16 Meter Size

Enter the applicable **ANSI** meter size. Only the menu choices in the following **ANSI table** is applicable to meters built in the US by ABB. DIN meter values are not applicable to meters built in the US. Entering a DIN size will cause discrepancies in metering values caused by pipe area differences in ANSI and DIN standards.

Meter Size

ANSI	
inch	**mm**
1	25
1½	40
2	50
3	80
4	100
6	150

DIN	
inch	**mm**
1	25
1½	40
2	50
3	80
4	100
6	150

3.17 Sub Menu k-Factor

NOTE
The meter is programmed (configured) by ABB prior to shipment. Therefore, the meter should not require k-factor adjustment in the field. Should re-entry be required, frequencies and k-factors can be found on the label inside the junction box cover of the flow computer

The k-factor is the relationship between vortex frequency and volumetric flow rate, and is the number of cycles per unit volume. The k-factor is used to calculate the flowrate at operating conditions. The k-factor is a function of the size of the flowmeter. To maximize accuracy a linearizing algorithm is provided that uses 2, 3, 4, 5, 6 or 7 values. If only one value is required, "Median" is selected. The median k-factor is stamped on the instrument tag.

Sub Menu
k-factor

k-Linearization

Menu Choices:

2 points
3 points
4 points
5 points
6 points
7 points
Median

3.17.1 k-Factor Linearization

This menu is available if 2 through 7 point calibration has been selected. It is possible to enter up to 7 calibration values in this menu (over the flowrate range). A linear interpolation is made between the entered points. First enter frequency f1 and then the corresponding k-factor k1 in cycles/m^3. Repeat this procedure until all the calibration points (2 through 7) have been entered. All frequencies must be less than or equal to 2500 Hz.
Example:

For 2 points enter the following values:

f1	k1
f2	k2

For 3 points enter the following values:

f1	k1
f2	k2
f3	k3

The points must be entered in ascending order; f1 < f2 < f3 < f4 < f5 < f6 < f7.

f 1 100 Hz

Valid Numerical Entries:

1 -2500

k 1 1000.0 1/m^3

$1/m^3$ represents cycles/m^3

Valid Numerical Entries: (NOTE: An entry of zero is acceptable to the firmware, however, all k-factors entered should be >0 to avoid problems with the meter operation.)

0.0 - 2,000,000

3.17.2 Unit k-Factor

This menu is available if Median has been selected in the k-factor menu. **The unit k-factor stamped on the instrument tag is entered by ABB.** The k-factor is in cycles/m^3.

unit k-factor

$1/m^3$ represents cycles/m^3
$1/ft^3$ represents cycles/ft^3

3.18 Flow Mode

Actual flow - actual volumetric flow
Normal flow - flow rate at normal temperature and pressure for gas and liquid selections only (not steam).
Mass flow - mass flow using operating density: The mass flow is calculated from the normal flow and the normal density, (mass flow = normal flow x normal density).

Flow Mode

Menu Choices:

Actual flow
Normal flow
Mass flow

3.19 Volumetric Extension

This menu appears when Liquid is selected in Sub-Section 3.15. Volumetric extension is the liquid volumetric temperature expansion in percent per degree Celsius.

Vol. extension %/ ^{o} C

Valid Numerical Entries:

0 - 100

3.20 Saturated Steam

This menu appears when Saturated Steam is selected in Sub-Section 3.15. Steam density is determined by which of the following menu choice is selected. Density is automatically calculated by the firmware. If Measure Pressure is selected refer to 3.36.4. If Measure Temperature is selected refer to 3.36.1.

Sat. Steam

Menu Choices:

Measure Press.
Measure Temperature

3.21 Sub Menu Gas Calculations

This menu is only available if the **process fluid** selection is **Gas** (refer to Sub-Section 3.15).

Sub Menu

Menu Choices:

Normal Conditions
Gas Calculation

The **normal** flowrate is calculated from the **actual** flowrate using the following formula:

where:

Qn = Normal Flowrate at P_n= 14.7 psia (1013 $m_{bar)}$, T_n= 498^o R (32^o F + 460))
Qb = Actual Flowrate at operating conditions (operating)
Zn = Real gas factor at normal conditions
Zb = Real gas factor at operating conditions
Pb = Line pressure psia
Pn = 14.7 psia
Tb = Line temperature ^{o}R (^{o}F + 460)
Tn = 498^o R

$$Qn = Qb \times \frac{Pb}{Pn} \times \frac{Tn}{Tb} \times \frac{Zn}{Zb}$$

$$= Qb \times \frac{Pb}{14.7} \times \frac{498}{Tb} \times \frac{Zn}{Zb}$$

The real gas factors take into account the deviation of the measured gas from an ideal gas.

3.21.1 Normal Condition

Allows selection of normal conditions calculated at 20^{o} C (68^{o} F) or 0^{o}C (32^{o} F).

Normal condition

Menu Choices:

1.0133 bar_ at 20^{o} C
1.0133 bar_ at 0^{o} C

3.21.2 Gas Calculation

Allows selection of gas parameters for calculation of flowrate compensation.

Gas Calculation

Menu Choices:

Ideal gas
van der Waals
Correction Coefficient.

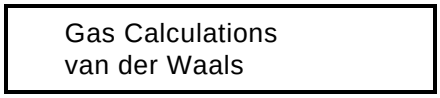
3.21.2.1 Ideal Gas

The calculation for an ideal gas is the same as the calculation in Sub-Section 3.21 except $\frac{Zn}{Zb} = 1$.

Gas Calculation Ideal gas

3.21.2.2 van der Waals

This sub menu is only available if **Gas** is selected in **Fluid** (see 3.15) and van der Waals is selected in Gas Calculation. It provides for the calculation of the real gas factors.



The following algorithm is used:

$$Z = 1 + \frac{P}{RxT} \text{ x } \left(b - \frac{a}{RxT} \right)$$

where a and b are the van der Waals constants (refer to Sub-Section 3.21.2.2.2).

3.21.2.2.1 van der Waals Table

Upon selection of a gas from the following table, the two van der Waals constants are entered as described in Sub-Section 3.21.2.2.2.

Menu Choices:	
Nitrogen	Hydrog. chloride
Helium	Hydrog. sulfide
Hydrogen	Methane
Argon	Acetylene
Neon	Ethylene
Chlorine	Ethane
Carbon monoxide	Propylene
Carbon dioxide	Propane
Sulfur dioxide	Benzene
Nitric oxide	n-Butane
Ammonia	Oxygen

3.21.2.2.2 van der Waals Constants

The van der Waals constants a and b can be manually entered in these two menu categories. The values can be viewed if a gas is selected in the menu.

van der Waals a

Valid Numerical Entries:

0.0 - 1000.0

van der Waals b

Valid Numerical Entries:

0.0 - 100.0

3.21.3 Correction Coefficient

The correction coefficient compensates for the deviation between real and ideal gas. A compensating factor can be entered in the compressibility parameter to compensate for the deviation between real and ideal gas.

Gas Calculations Correction coefficient

Press ENTER and the following display appears:

Compressibility

Valid Numerical Entry

0.0 - 2.0

3.22 Unit Density

Enter unit density - used with **Mass Flow** (refer to sub-section 3.18).

Unit Density

Menu Choices:
g/ml
g/cm^3
g/l
kg/l
kg/m^3
lb/ft^3
lb/ugl

3.23 Normal Density

Selection of the normal density for calculation of mass or normal flow are made in this menu. The gas density unit is always kg/m^3 at **14.7 psia and 32^o F (0^o C)**. The normal density is set to 0 during initialization so that the mass flow and normal flow are calculated as 0. The normal density is set to zero by the converter when **Fluid** is changed (refer to Sub-Section 3.15).

Density

Valid Numerical Entries:

0.0000 - 20.0000

Normal densities for various gases: (These densities are valid when normal conditions of 1.0133 bar_ at 0^o C is selected in 3.21.1.)

GAS	DENSITY (kg/m^3)
Nitrogen	1.25
Helium	0.177
Hydrogen	0.0899
Argon	1.78
Neon	0.871
Chlorine	3.22
Carbon monoxide	1.25
Carbon dioxide	1.97
Sulfur dioxide	2.93
Nitric oxide	1.34
Ammonia	0.771
Hydrog. chloride	1.633
Hydrog. sulfide	1.529
Methane	0.717
Acetylene	1.172
Ethylene	1.26
Ethane	1.36
Propylene	1.915
Propane	2.02
Benzene	3.485
n-Butane	2.717
Oxygen	1.43
Air	1.29

3.24 Unit Qv (volumetric)

Used with **Actual** flow mode only (refer to Sub-Section 3.18).

Unit Qv

Menu Choices:					
l/s	igps	usgps	ft^3/s	m^3/s	*bbl/s
l/m	igpm	usgpm	ft^3/m	m^3/m	*bbl/m
l/h	igph	usgph	ft^3/h	m^3/h	*bbl/h
---	igpd	**usmgd	ft^3/d	m^3/d	*bbl/d

*bbl = 42 gallons
** usmgd = million gallons per day

3.25 Unit Qm (mass flow)

Used with **Mass** flow mode only (refer to Sub-Section 3.18).

Unit Qm

Menu Choices:			
g/s	kg/s	*t/m	lb/s
g/m	kg/m	*t/h	lb/m
g/h	kg/h	*t/d	lb/h
---	kg/d	---	lb/d

* t = metric ton (1000 kg)

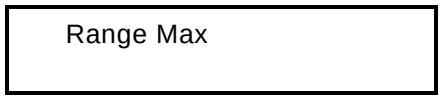
3.26 Meter Range Maximum

This is a read only parameter. This parameter reads maximum flow per meter size. Maximum range at 20 mA is set at Sub-Section 3.27. The units displayed in this parameter are actual volmetric units (3.24) even if Normal or Mass are selected in 3.18.

Meter Range Max

3.27 Range Maximum

Range Maximum is the flow rate at which the output shall be equal to 20 mA. Enter value that corresponds to 20 mA. Value must be greater than 20% and less than 100% of Meter Range Max. (refer to Sub-Section 3.26).



3.28 Range Minimum (low flow cutoff)

When flow rate is below Range Minimum the output is driven to 4 mA. Enter a value that corresponds to the minimum flow to be displayed. Zero flow equals 4 mA. Value must be less than 10% of Meter Range Max (refer to Sub-Section 3.26).

3.29 Sub Menu Totalizer

3.29.1 Totalizer

The totalizer sums the flow in accordance with the selected flow mode. An overflow is activated each time the totalizer count exceeds 10,000,000. The maximum number of overflows which can be stored in the overflow register is 65,535. Therefore, the maximum totalizer counts is:

65,535 x 10,000,000 = 655,350,000,000

This is a read only parameter (refer to 3.29.4).

3.29.2 Overflow

When the **totalizer** reaches its maximum count it "rolls over" to zero. Each "roll over" is counted as an **overflow** (refer to 3.29.1). **This is a read only parameter.**
Example:

Number of overflows = 12
Maximum totalizer count = 10,000,000
Present totalizer count = 4,789

12 x 10,000,000 = 120,000,000
120,000,000 + 4,789 = 120,004,789

Overflow
0

3.29.3 Unit Totalizer

Select applicable unit of measure. Appropriate Flow Mode must be selected in Sub-Section 3.18.

Unit Totalizer

Menu Choices:	
Normal flow/ Actual flow	Mass flow
usgl	kg
igal	**t
*bbl	lb
l	g
m^3	---
ft^3	---

*bbl = 42 gallons
**t = metric tons (1000 kg)

3.29.4 Function Totalizer Reset

Used to reset the totalizer and overflow to zero.

Function
Totalizer reset

3.30 Sub Menu Pulse Output

Pulse output is configured to correspond to the application.

Sub Menu Pulse Output

Menu Choices:
Pulse Factor
Pulse Width

3.30.1 Pulse Factor

The pulse factor is equivalent to the number of pulses per measured flow unit for the external pulse output and for the internal totalizer. When the pulse factor is changed the totalizer value remains in the totalizer units selected (3.29.3). Totalizer should be reset to zero (3.29.4). The pulse factor can be selected between 0.001 and 1000 pulse/flow-unit.

Pulse Factor /I

Valid Numerical Entries:

0.001 - 1000

3.30.2 Pulse Width

The pulse width for the scaled pulse output can be set between 0.016 and 1000 ms. The pulse width must be set less than the period of the maximum pulse frequency (at 115% of flow). Mechanical counters require a pulse width of at least 30 ms.

Pulse Width ms

Valid Numerical Entries:

0.016 - 1000

3.31 Damping

Damping controls the rate at which the unit responds to changes in flow. Without damping, it will show a 100% change in flow in approximately 1 second. By entering various values for damping, the full scale response can be slowed to 100 seconds. This is not a linear function. Response will be faster in the first few seconds of the damping interval than during the last few seconds. Damping is used to smooth out pulsating flow signals that are caused by pumps and to reduce output oscillations that are created by process generated noise.

Damping

Valid Numerical Entries:

0.2 through 100s

3.32 Sub Menu Flow Alarm

Minimum and maximum alarm flowrates can be set based on the measured flowrate. The firmware provides constant 1% hysteresis around the selected minimum and maximum alarm values.

Sub Menu Alarm

3.32.1 Minimum Alarm

Input minimum alarm in %

Min-alarm < %

Valid Numerical Entries:

0 - 115

3.32.2 Maximum Alarm

Input maximum alarm in %

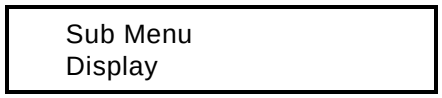
Max-alarm > %

Valid Numerical Entries:

0 - 115

3.33 Sub Menu Display

There are several options available for flow value displays. The first and second lines of the display can be programmed in this menu.



3.33.1 Display 1. row

Both lines of the display can be configured in the menu. Select a parameter for the first row of the display.

Display 1. line

Menu Choices:

Qv operate
Qn norm
Qm Mass
Percent
Percent, Bar
Totalizer
Pressure
Temperature
Press + Temp
Frequency
Freq no damping
Freq search
Freq jitter
A/D T_{ref}
A/D T_{mess}
A/D P_{mess}

Qv = Actual flowrate
Qn = Normal flowrate
Qm = Mass flowrate
Percent = Flowrate in the selected flow units as a percent of the selected maximum flowrate Range max
Percent, Bar = as above, except displayed as a bar
Totalizer = Sum of flowrate
Pressure and/or Temperature = Measured or entered Pressure and/or Temperature values
Frequency = The frequency in Hz measured in the converter
Freq no damping = Measures converter frequency without damping
Freq search = Diagnostic display of voltage before and after tracking band-pass filter
Freq jitter = Measures converter frequency instability displayed as percent (%). Only functional if "liquid" is selected as fluid.
A/D T_{ref} = Diagnostic display of P/T module temperature reference conversion A/D value.
A/D T_{mess} = Diagnostic display of P/T module temperature conversion A/D converter value.
A/D P_{mess} = Diagnostic display of P/T module pressure conversion A/D converter value.

3.33.2 Display 2. row

Select a parameter for the second row of the display.

Display 2. line

Menu Choices:

- Qv operate
- Qn norm
- Qm Mass
- Percent
- Percent, Bar
- Totalizer
- Pressure
- Temperature
- Press + Temp
- Frequency
- Freq no damping
- Freq search
- Freq jitter
- A/D T_{ref}
- A/D T_{mess}
- A/D P_{mess}

3.33.3 Multiple Indications on the Second Line

The Multiplex feature automatically switches selected values so that they are alternately displayed (approximately every five seconds). This will continue as long as the Multiplex feature is **ON**. This is a ON - OFF function selected by the arrow keys and entered with the enter key. Two different flow indications can be alternately shown in the second line of the display.

Multiplex must be in the **ON** mode.

Multiplex

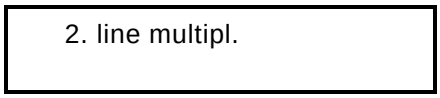
Menu Choices:

- Off
- On

3.33.4 Multiplex Parameters on the Second Line

This menu appears only if MULTIPLEX is in the **ON** mode. The parameter to be multiplexed is selected from this menu.

Example:
If the Totalizer is installed on the second line and the value Pressure is selected to be the "multiplex" parameter on the second line, then the display will alternate every five seconds between the totalizer and the pressure values.



Menu Choices:

Qv operate
Qn normal
Qm Mass
Percent
Percent, Bar
Totalizer
Pressure
Temperature
Press + Temp
Frequency
Freq no damping
Freq search
Freq jitter
A/D T_{ref}
A/D T_{mess}
A/D P_{mess}

3.34 Sub Menu Current Output

This sub menu is used to set the current output parameters.

Sub Menu Current Output

3.34.1 Current Output Range

Select the current output range.

Current Out mA

Menu Choices:

0-20 mA
4-20 mA
0-10 mA
2-10 mA

3.34.2 Alarm Current Output

The alarm is set for high or low output current condition during alarm.

I_{out} at Alarm %

Menu Choices:

0 %
115%

3.35 Sub Menu - Pressure Input

The pressure is configured in this menu. The pressure input is a current input derived from a 2 or 4 wire pressure transmitter.

Sub Menu Pressure Input

3.35.1 Type of Pressure Input

Characterization of pressure input parameters. The first number corresponds to 0% and the second to 100% at the current input (e.g. current input 4 - 20 mA: 4 mA = 0%, 20 mA = 100%).

Pressure Input mA

Menu Choices:

0 - 20 mA
4 - 20 mA
0 - 10 mA
2 - 10 mA

3.35.2 Pressure Measurement Range for the transmitter

Enter the range limits for the pressure input.

Pressure 0% bar_a

Valid Numerical Entries:

0.0 - 100.0

Input P_{min} (bar absolute) for 0% current

Pressure 100% bar_a

Valid Numerical Entries:

0.0 -100.0

Input P_{max} (bar absolute) for 100% current

3.36 Sub Menu - Pressure/Temperature (P/T) Module (option)

Used to determine if the pressure and temperature inputs are to be used for the P/T compensation or if constants are to be used.

Submenu P/T Module

3.36.1 Measurement Temperature

When OFF is selected, a constant temperature value can be entered. When ON is selected, the RTD supplied temperature is used in the calculation (requires optional P/T module).

Measure temp.

Menu Choices:

on
off

3.36.2 Temperature Units

The temperature units are set in this menu. When the units are changed, a constant temperature value, if entered, is automatically converted in both temperature units.

Units temp.

Menu Choices:

C = Celsius
F = Fahrenheit

3.36.3 Constant Temperature

This menu is only available if OFF is selected in Measure Temperature (3.36.1). Input the constant operating temperature.

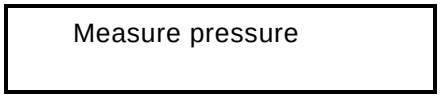
Const. Temp. ^{o} C/F

Valid Numerical Entries:

–200 - +400^{o} C

3.36.4 Measure Pressure

The pressure transmitter input can be used when ON is selected. When ON is selected the transmitter current output is used to calculate the line pressure (requires optional Pressure/Temperature module). When OFF is selected, a constant pressure can be entered.

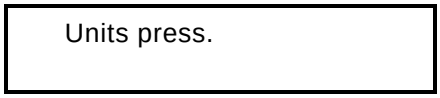


Menu Choices:

On
Off

3.36.5 Pressure Units

The pressure units are set in this menu. When the units are changed, a constant pressure value, if entered, is automatically converted in both pressure units.



Menu Choices:

bara
PSIA

3.36.6 Constant Pressure

This menu is only available if OFF is selected in Measure Pressure (3.36.4). Input the constant operating pressure in bar absolute or PSIA as selected in 3.36.5.

Valid Numerical Entries:

0 - 100 bara
0 - 1450 PSIA

3.37 Sub Menu Frequency Search

The band pass settings are based on the frequency measurement of the vortex meter. The preamplifier output signal is fed to a frequency counter (frequency measurement) through a programmable band pass. The programmable band pass range is 1 - 2500 Hz. (1:2500). The measurement frequency from the flowmeter is sought within this frequency range. The setting of the dwell time is required because of a loss of the primary signal/shedder frequency could occur, if, for example, air bubbles were contained in the metered liquid. The computer must continually search within the bandpass limits for the flow signal. Default values are entered automatically when meter size and fluid are chosen. These default values may be changed as follows.

Sub Menu Freq. search

3.37.1 Maximum Frequency

This parameter sets the high end of the bandpass. The converter increases the programmed value by a 1.3 factor to assure a setting greater than the frequency at 130%.

max. Frequency Hz

Valid Numerical Entries:

$$2500 \geq F_{max} \geq 2\ F_{min}$$

3.37.2 Minimum Frequency

The minimum frequency is the low end of the bandpass. The converter decreases the programmed value by a 0.9 factor to accept a flow slightly below the flow range minimum.

min. Frequency Hz

Valid Numerical Entries:

$$1 \leq F_{min} \leq \tfrac{1}{2}\ F_{max}$$

3.37.3 Dwell Time For Measurement Frequency After Signal Loss

The time the measurement signal is held after a signal loss can be programmed in this parameter. This function will hold the last output value in the event of sensor signal lose until programmed time has expired.

Time freq. hold sec

Valid Numerical Entries:

0.1 - 10.0

3.38 Sub Menu Interface

This sub-menu is used to set various communication parameters. Press enter and use the arrow keys to select a parameter.

Sub Menu Interface

3.38.1 Communications

For operation with the ASCII protocol, the instrument must contain the serial data link module RS232 or RS485. For operation with HART-Protocol the instrument must contain the HART-current output module. Press enter and use the arrow keys to make a menu choice.

Communications

Menu Choices:

ASCII
HART

3.38.2 Baudrate

The baudrate for the serial data link is selected in this parameter. The baudrate applies to the ASCII communication and output data. Press enter and use the arrow keys to make a menu choice.

Baudrate

Menu Choices:

110
300
600
1200
2400
4800
9600
14400
19200
28800

3.38.3 Instrument Address

Instruments connected in parallel can be addressed from a host computer using ASCII Protocol with the RS485 module. Press enter and use the keys to enter a number.

Instrument Address

3.38.4 Printer Type

All parameter settings of the instrument can be sent to a printer using the output data parameter (3.38.5). The printer type is selected in this parameter. Press enter and use the arrow keys to make a menu choice.

Printer Type

Menu Choices:

Standard - at the end of a line only a carriage return is transmitted.
ABB Docuprint - ABB Printer
Standard CR LF - at the end of a line a carriage return and line feed are transmitted.

3.38.5 Function Output Data

When this parameter is selected all input parameters set in the instrument are transmitted at the selected baudrate over the serial data link. The sequence is the same as if the UP arrow was used to page through the menus. The output is transmitted regardless of the protocol selected (ASCII or HART).

3.39 Sub Menu Self Check

Self Checks are firmware-driven test routines which verify that the system is operating properly.

Sub Menu Self Check

Pressing an arrow key will toggle through the following parameters.

Function I_{out}

Press Enter and a % will appear. A percentage of the output can be entered and the output will go to that value.

Function F_{out}

Press Enter and a % will appear. A percentage of the output can be entered and the output will go to that value.

Function Alarm

Pressing Enter toggles the general alarm output appearing at terminals V5 and V6.

Function Max-Alarm

Pressing Enter toggles the maximum alarm output appearing at terminals V10 and V11.

Function Min-Alarm

Pressing Enter toggles the minimum alarm output appearing at terminals V12 and V13.

Function Zero return

Always off - test not available.

```
Function
Totalizer reset
```

Always off - test not available.

```
Function
Display
```

The characters 1234567890ABCDEF are displayed to check both lines of the display.

```
Function
Data Link
```

The Data Link check requires that jumpers be installed in the wiring so that the converter can transmit and receive its own signal. For the RS 232 link, place the jumper between terminals V2 and V4. For the RS 485 link, place a jumper between terminals V1 and V3 and another between T+ and R+. These terminals are located in the customer connection box.

During this test the instrument continuously transmits and receives the character "1" over the jumper. The number of transmitted characters is displayed at the lower left and the number of errors is displayed at the lower right of the display.

```
Data Link
123          0
```

After 1000 characters have been transmitted the procedure is terminated and the following is displayed.

```
Data Link
Errors:      0
```

During the display time additional "1" characters are transmitted but not counted. Pressing any key will terminate the test and display the previous menu.

The test cannot be accessed from the ASCII Protocol in the terminal mode (ASCII or Data Terminal). The following message will appear.

```
Error
Terminal mode
```

The test cannot be initiated from communication using the HART Protocol. The following message will appear.

Error Protocol

Function RAM

Self Tests RAM

Function NVRAM

Self Tests NVRAM

Function EPROM

Self Tests EPROM

Function EEPROM

Self Tests EEPROM on digital board.

Function External EEPROM

Self Test EEPROM on connection board.

Function HART-Transmitter

Outputs frequencies equivalent to HART "0" or HART "1" levels.

Function HART-Command

Pressing Enter displays the HART command number if a HART input is given.

3.40 Sub Menu Error Register

All error messages and power outages are stored in these registers. The error number displayed is a code which identifies the type of error. Refer to Table 3-1.

Sub Menu

Menu Choices:

Error Register
Mains interrupt

3.40.1 Error Register

Indicates error code numbers which have occurred (refer to Table 3-1). The error register can be reset with the Error Reset parameter 3.43.2.

Error Register

3.40.2 Mains Interrupt

Indicates the number of power outages. The mains interrupt can be reset with the Error Reset parameter 3.43.2.

Mains interrupt

3.41 Load and Store Configuration Data from the External EEPROM

Configuration data associated with a 50VM1000 and a specific flowmeter can be saved in both the EEPROM located on the pc board in the base of the enclosure (P/N D685A481U02) and on the upper digital pc board (P/N D685A484U03). If the upper digital pc board containing the display must be replaced, the data stored in the EEPROM located on the lower board can be loaded to the replacement upper board without requiring re-entry of the parameters. However, calibration data described in Sub-Sections 3.43.5 and 3.43.6 must be re-entered. After calibration, activating the Store Data (3.41.1) and Load Data Parameters (3.41.2) will make data in both EEPROMS match. If the lower pc board is replaced, data stored in the upper board EEPROM can be entered in the lower board EEPROM using the Store Data Parameter (3.41.1).

Totalizer, Error Register and Mains Interrupt data is stored in the NVRAM, not the EEPROM.

Refer to Figure 3-2.

3.41.1 Store Data in the External EEPROM

To activate the store data function, press the direct access (decimal point) key or toggle through the parameters and press Enter.

```
Store data in
ext. EEPROM
```

3.41.2 Load Data from the External EEPROM

To activate the load data function, press the direct access (zero) key or toggle through the parameters and press Enter.

```
Load data from
ext. EEPROM
```

3.42 Firmware Version

The firmware level and the model number are shown in the display with the model number and firmware release date on the top line, and the EPROM identification and firmware level on the bottom line. Changes to the firmware can only be made by replacing the EPROM. When communicating with ABB, reference the firmware version (A.31) of the instrument.

```
50VM1000       01/94
D699B095U01    A.31
```

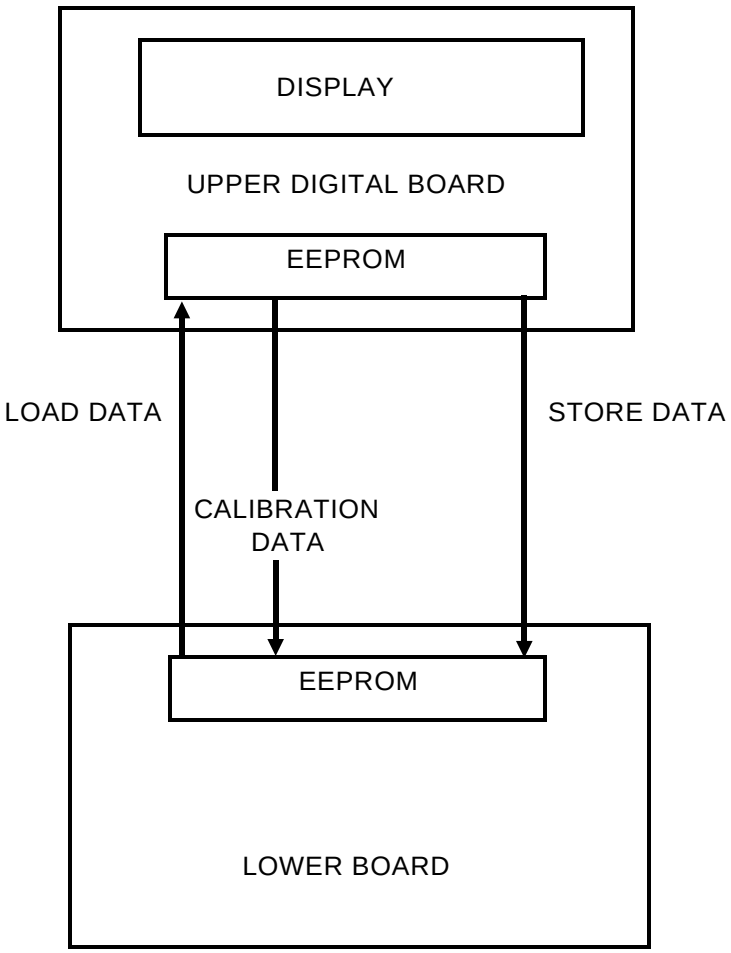


FIGURE 3-2. EEPROM DATA TRANSFER

3.43 Code Number (Calibration Parameters)

Access to calibration parameters is achieved by entering the correct code number (1 to 9999). **In order to enter the calibration mode it is necessary to enter the code number**. The calibration mode is locked out without the entry of the correct code number or after a power-on reset.

After the correct code number has been entered the program protection (3.12) is automatically turned OFF. Access is terminated if an incorrect code number is entered. Entering an incorrect number will automatically turn program protection ON.

To enter a code number, use the arrow keys until the following display appears. Press enter and use the number keys to enter the code number. The code number does not appear on the display (asterisks will be displayed).

```
Code Number
****
```

Ten minutes after the last key has been pressed the code number mode is **deactivated and program protection is turned ON.**

The following parameters only appear in the Code Number mode.

3.43.1 Instrument Number

The instrument number is entered by ABB, however, it can be changed by the user.

```
Instrument number
```

3.43.2 Function Reset Error

The individual error messages and mains interrupts are stored until the reset in this menu is activated by pressing the ENTER key.

```
Function
Reset error
```

3.43.3 Function Initialize EEPROM

Initializing the EEPROM will delete the stored data.

If initialize is selected, all parameters are set to their default values.
Use this with caution: **calibration data must be re-entered following initialization.**

Function
Init EEPROM

3.43.4 Function Initialize k-Factor

Clears k-factor values entered into the instrument.

Function
Init k-factor

3.43.5 Adjust Current Output

An ammeter connected in series with the output terminals, is required for the current output calibration. Upon selection of Adjust I_{out} 4 mA the converter produces approximately 4 mA at the output terminals. The exact value of the current is to be determined with the ammeter and entered at this time. After completion of the entry, the entered value will be displayed. Similarly the measured value is entered in the Adjust I_{out} 20 mA location. Values may be verified by entering the self-check menu and performing the "Function I_{out}" test at 0 and 100%.

Function
Adjust I_{out} 4 mA

Valid Numerical Entries:

2.0 - 6.0

Function
Adjust I_{out} 20 mA

Valid Numerical Entries:

10.0 - 30.0

3.43.6 Adjust Current Input

A current source with a precise 4 mA and 20 mA output into a 200 ohm load is required to calibrate the current input. This source is connected to the pressure input. After a current of 4 mA is introduced at the pressure input connection, select Adjust I_{in} 4 mA. A similar procedure is used to set the Adjust I_{in} 20 mA.

NOTE
This adjustment should only be performed with a current source at the pressure input connection. Performing this adjustment without a pressure input will result in improper operation of the system.

Function
Adjust I_{in} 4 mA

Function
Adjust I_{in} 20 mA

To adjust the 4 mA value of the current input, apply a 4.00 mA input current to the pressure input and select the following parameter.

Adj. I_{in} 4 mA
4.000 mA

After selecting the above parameter the following display will appear.

Automatic → 1
Manual → 2

1. After pressing "1" the converter automatically adjusts the 4 mA value. However, before starting the procedure the following warning is displayed because the old value will be overwritten.

* Warning *
Proceed → Enter

Pressing any key other than ENTER terminates the procedure. Pressing ENTER initiates the automatic adjustment. The converter makes a number of measurements and uses the average for the adjustment value. This procedure takes approximately 16 seconds. Upon completion of the procedure the new value will be displayed.

2. After pressing "2" the calibration value can be entered manually.

Adj. I_{in} 4 mA
___

This may be necessary if the EEPROM was reinitialized and the current input must be readjusted.

3.43.7 Error 9

Error code 9 can be turned **ON** or **OFF** using this parameter. When error code 9 is turned **off,** no error message will appear when the flowrate exceeds 115% of QmaxDN. When error code 9 is turned **on**, an error indication will appear in the error register (3.39.1).

Error 9

Menu Choices:

on
off

3.43.8 Function Output Data

When this parameter is selected all input parameters set in the instrument are transmitted at the selected baudrate over the serial data link. The sequence is the same as if the UP arrow was used to page through the menus. The output is transmitted regardless of the protocol selected (ASCII or HART).

Function Output Data

3.43.9 Diagnosis Frequency Measurement

Diagnostic utility that transmits information on meter operation via the optional serial interface. For ABB use only.

Diagnosis Freq. measurement

3.43.10 Frequency Correction

With frequency correction "ON", the firmware measures the flow signal’s frequency instability and applies a "correction factor" to the measured frequency. This applies only if "Liquid" is selected in the Fluid menu.

Freq. correction

Menu Choices:

on
off

4.0 DATA LINK COMMUNICATIONS

4.1 General Description of Data Link

There are two communication protocols available in the converter 50VM1000 with which data in on-line operation is accessed and programmed.

HART-Protocol
ASCII Protocol

HART-Protocol information is transmitted using a modem by Frequency Shift Keyed (FSK) modulation on the current output.

Data is transmitted over the RS232 or RS485 data link with the ASCII Protocol.

The following transmission speeds can be selected:

110, 300, 600, 1200, 2400, 4800, 9600, 14400, 28800 baud

The communication format is:

START B0 B1 B2 B3 B4 B5 B6 PARITY STOP

START = 1 Start bit
B0 - B6 = 7 data bits
PARITY = 1 Parity bit (even)
STOP = 1 Stop bit

The converter hardware can include a RS232 or RS485 data link. The RS232 is not bus compatible, i.e., communication with only one instrument over a single line is possible as shown in Figures 4-1 and 4-2. See Figures 4-3 and 4-4 for RS485 communication.

4.2 ASCII Communication Protocol

The communication is always initiated from a host computer. The converter always responds to the corresponding command from the host computer.

Data can be retrieved from the converter (monitor mode) or the converter can be programmed (programming mode).

The communication always begins with the character SOH (Start of header = 01H) followed by "M" for monitor mode or "P" for programming mode as well as a 2 digit instrument address. Two character codes follow for the requested function and then a maximum of 8 data bytes are transmitted. The transmission is concluded with CR (carriage return = 0DH) and LF (line feed = 0AH).

The converter also responds with SOH followed by the two character codes and up to 8 data bytes. The transmission is concluded with CR and LF.

The data can contain signs ("-" for minus) and periods ("." for decimal point). Leading or extra zeroes are not required.

All data received by the converter is checked in a multitude of ways. In addition to the even parity check the converter monitors for exact conformity to the communication protocol (character codes as well as the number and type of the data). Additionally before the data is accepted it is subjected to a plausibility check. In case of an error the converter sends an error message (code "X" and a two digit error code). If no error is recognized the new data is accepted by the converter and is retransmitted to the host computer as confirmation. Then the transmission is ended.

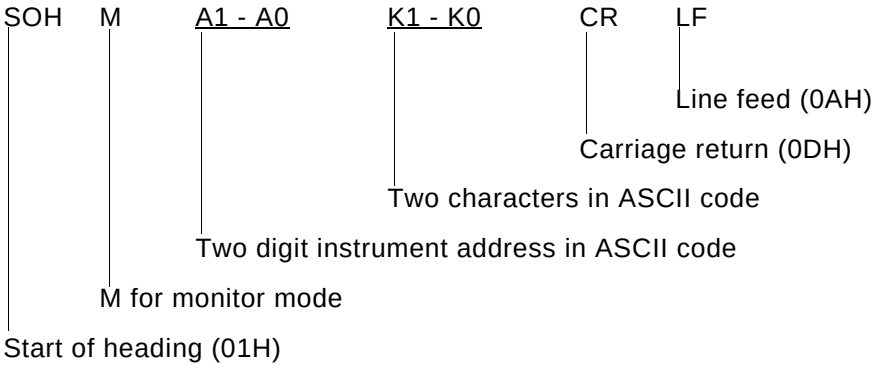
4.3 Monitor Mode

In this mode all the parameter settings, status information, and measured values can be accessed from the converter.

The corresponding protocol has the following format:

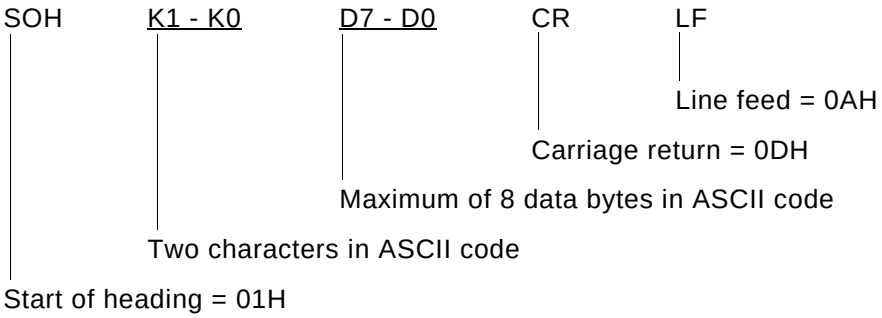
a) Command from the host computer

Host computer → converter



b) Response from converter

Converter → host computer



A maximum of 8 data bytes can be transmitted by the converter. The entry of the instrument address must contain two digits.

4.3.1 Monitor Mode Codes

4.3.1.1 A1 Display Line 1

Interrogate what is shown in the first line of the display. The output contains 1 or 2 digits.

INDEX NUMBER	MODE
0	Qv actual
1	Qn standard
2	Qm mass
3	Percent
4	Percent bar graph
5	Totalizer
6	Pressure
7	Temperature
8	Pressure + temperature
9	Frequency
10	Freq undamped *
11	Freq measurement *
12	Freq jitter *
13	A/D Treference *
14	A/D Tmeasured *
15	A/D Pmeasured *

* For ABB use only.

Example:

Display Line 1 for instrument 01 is set at 5.

Host	SOHM01A1CRLF
Converter	SOHA15CRLF

4.3.1.2 A2 Display Line 2

Interrogate what is shown in the second line of the display.

Example:

Display Line 2 for instrument 01 is set at 5.

Host	SOHM01A2CRLF
Converter	SOHA25CRLF

4.3.1.3 A3 Display Line 2 Multiplex

Interrogate what is displayed in the second line for the multiplex mode (see 4.3.1.1 and 4.3.1.5).

Example:

Display Line 2 for instrument 01 is set at 5.

Host	SOHM01A3CRLF
Converter	SOHA35CRLF

4.3.1.4 AK Correction Coefficient

Interrogate the correction coefficients for the gas calculation. This is only available when:

1) gas is selected in the fluid parameter (see 4.3.1.39)
2) correction coefficient is selected in the gas calculation parameter (see 4.3.1.27)

The correction coefficients are dimensionless. The output contains three decimal places.

Example:

Correction Coeficient for instrument 01 is set at 1.

Host	SOHM01AKCRLF
Converter	SOHMAK1CRLF

4.3.1.5 AM Multiplex

Interrogate if the multiplex mode for measurement displays is turned on.

INDEX NUMBER	MODE
0	off
1	on

Example:

Multiplex for instrument 01 is turned on.

Host	SOHM01AMCRLF
Converter	SOHAM1CRLF

4.3.1.6 AN Minimum Alarm

Interrogate the threshold setting for the minimum alarm. The output is in percent.

Example:

Minimum alarm for instrument 01 is set at 10%.

Host	SOHM01ANCRLF
Converter	SOHAN10CRLF

4.3.1.7 AX Maximum Alarm

Interrogate the threshold setting for the maximum alarm. The output is in percent.

Example:

Maximum alarm for instrument 01 is set at 90%.

Host	SOHM01AXCRLF
Converter	SOHAX90CRLF

4.3.1.8 BA Baudrate

Interrogate the baudrate selected for the serial data link.

INDEX NUMBER	BAUD RATE
0	110
1	300
2	600
3	1200
4	2400
5	4800
6	9600
7	14400
8	19200
9	28800

Example:

Buad rate for instrument 01 is set at 1200.

Host	SOHM01BACRLF
Converter	SOHBA3CRLF

4.3.1.9 BE Operating Mode

Interrogate the operating flow measurement mode setting of the converter.

INDEX NUMBER	MODE
0	Actual
1	Normal
2	Mass

Operating mode for instrument 01 is set at 1.

Host SOHM01BECRLF

Converter SOHBE1CRLF

4.3.1.10 DI Normal Density

Interrogate the normal density value setting. This is only available when gas or liquid has been selected in the fluid parameter. The output is the value in the density units selected (see 4.3.1.17).

Example:

Instrument number 01 is configured for 0.8 g/cm^3 density.

Host SOHM01DICRLF

Converter SOHDI0.8CRLF

4.3.1.11 DP Damping

Interrogate the damping setting in seconds. This represents the time it takes the converter to move to 63% of its final value after a step flow change.

Example:

Instrument number 01 is configured for 12 seconds damping.

Host SOHM01DPCRLF

Converter SOHDP12CRLF

4.3.1.12 DT Printer Type

Interrogate which printer type has been selected for data output.

INDEX NUMBER	MODE
0	Standard
1	ABB Docuprint
2	Standard CR LF

Instrument number 01 is configured for Printer 2.

Host	SOHM01DTCRLF
Converter	SOHDT2CRLF

4.3.1.13 E1 Units Qv

Interrogate the volumetric flow units selected. This applies to $Q_{max}DN$, Q_{max} (only in the actual and standard operating modes), Q_{min} as well as for the display of the actual (Qv) and standard (Qn) flowrates.

INDEX NUMBER	ABBREVIATION
0	l/s
1	l/m
2	l/h
3	m^3/s
4	m^3/m
5	m^3/h
6	m^3/d
7	ft^3/s
8	ft^3/m
9	ft^3/h
10	ft^3/d
11	usgps
12	usgpm
13	usgph
14	usgpd
15	igps
16	igpm
17	igph
18	igpd
19	bbl/s
20	bbl/m
21	bbl/h
22	bbl/d

Example:

Units Qv for Instrument number 01 is set at 1.

Host	SOHM01E1CRLF
Converter	SOHE11CRLF

4.3.1.14 E2 Units Qm

Interrogate the gravimetric flow units selected. This applies for Q_{max} (only in the mass operating mode) as well as for the mass flowrate indication (Qm).

INDEX NUMBER	ABBREVIATION
0	g/s
1	g/m
2	g/h
3	kg/s
4	kg/m
5	kg/h
6	kg/d
7	t/m
8	t/h
9	t/d
10	lb/s
11	lb/m
12	lb/h
13	lb/d

Example:

Units Qm for Instrument number 01 is set at 1.

Host	SOHM01E2CRLF
Converter	SOHE21CRLF

4.3.1.15 E3 Units Totalizer

Interrogate the totalizer volumetric units selected. This applies to the totalizer. The request is only available when actual or standard have been selected in the operating mode menu.

INDEX NUMBER	ABBREVIATION
0	l
1	m^3
2	ft^3
3	usgal
4	igal
5	bbl

Example:

Units Toalizer for Instrument number 01 is set at 1.

Host	SOHM01E3CRLF
Converter	SOHE31CRLF

4.3.1.16 E4 Units Totalizer

Interrogate the totalizer gravimetric units selected. This applies to the totalizer. This is only available when mass has been selected in the operating mode menu.

INDEX NUMBER	ABBREVIATION
0	g
1	kg
2	t (metric)
3	lb

Example:

Units Toalizer for Instrument number 01 is set at 1.

Host	SOHM01E4CRLF
Converter	SOHE41CRLF

4.3.1.17 E5 Units Density

Interrogate the density units selected. This is only available when gas or liquid has been selected in the fluid parameter.

INDEX NUMBER	ABBREVIATION
0	g/ml
1	g/cm^3
2	g/l
3	kg/l
4	kg/m^3
5	lb/ft^3
6	lb/usgl

Example:

Units Density for Instrument number 01 is set at 1.

Host	SOHM01E5CRLF
Converter	SOHE51CRLF

4.3.1.18 E6 Units k-Factor

Interrogate the k-Factor units selected.

INDEX NUMBER	ABBREVIATION
0	l/m^3
1	l/ft^3

Units k-Factor for Instrument number 01 is set at 1.

Host	SOHM01E6CRLF
Converter	SOHE61CRLF

4.3.1.19 E7 Units Temperature

Interrogate the temperature units selected.

INDEX NUMBER	TEMPERATURE UNITS
0	Celsius
1	Fahrenheit

Units Temperature for Instrument number 01 is set at 1.

Host	SOHM01E7CRLF
Converter	SOHE71CRLF

4.3.1.20 E8 Units Pressure

Interrogate the pressure units selected.

INDEX NUMBER	PRESSURE UNITS
0	bara (bar absolute)
1	PSIA (PSI absolute)

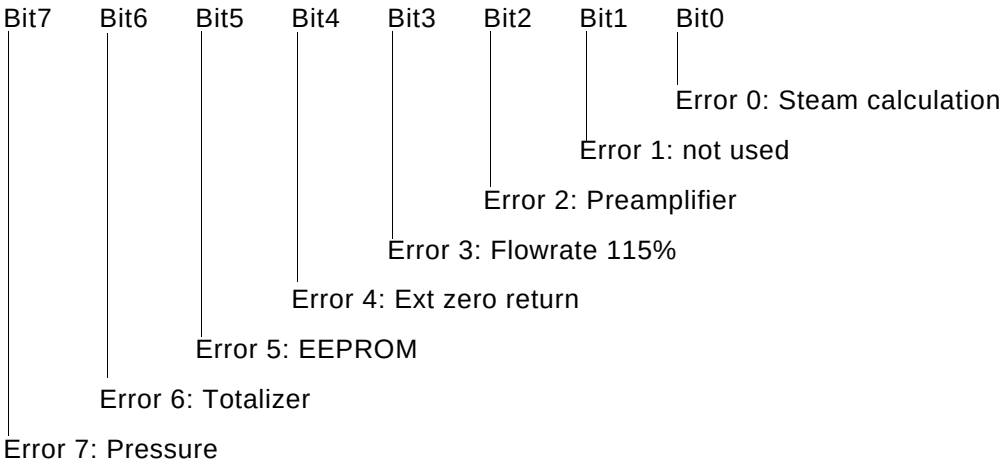
Units Pressure for Instrument number 01 is set at 1.

Host	SOHM01E8CRLF
Converter	SOHE81CRLF

4.3.1.21 ER Error Register

Interrogate the error register contents. This register contains the presently active errors, i.e. the errors which are signalled over the alarm contacts of the converter.

The eight bits of the error register are transmitted as eight ASCII characters ("0" = no error or "1" = active error) in the following format:



The error register is not altered by the interrogation. See 4.3.1.37 and 4.3.1.56.

Example:

Read Error Register for instrument 01.

Host	SOHM01ERCRLF
Converter	SOHER3CRLF

4.3.1.22 F1-F7 Frequency f1 to f7

Interrogate the frequencies f1 to f7 for the k-Linearization. The number of values to be entered must be the same as the number of points set in the k-linearization menu (average value or 2 to 7 see 4.3.1 34). The units are in Hz. Only whole numbers are transmitted.

Example:

Frequency for f1 for Instrument number 01.

Host	SOHM01F1CRLF
Converter	SOHF10CRLF

4.3.1.23 FH Frequency Hold Time

Interrogate the frequency hold time setting. The output contains one decimal place. The units are seconds.

Example:

Frequency Hold Time for Instrument number 01 is set at 3.

Host	SOHM01FHCRLF
Converter	SOHFH3CRLF

4.3.1.24 FK Frequency Correction (For ABB use only.)

Interrogate if the frequency correction is turned on.

INDEX NUMBER	MODE
0	off
1	on

4.3.1.25 FN Minimum Frequency

Interrogate the minimal frequency, i.e. the lower limit of the frequency search range. The output is in whole numbers of Hz.

Example:

Minimum Frequency for Instrument number 01 is set at 100.

Host	SOHM01FNCRLF
Converter	SOHFN100CRLF

4.3.1.26 FX Maximum Frequency

Interrogate the maximum frequency, i.e. the upper limit of the frequency search range. The output is in whole numbers of Hz.

Example:

Maximum Frequency for Instrument number 01 is set at 2500.

Host	SOHM01FXCRLF
Converter	SOHFX2500CRLF

4.3.1.27 GB Gas Calculation

Interrogate the gas calculation method selected. This is only available when gas has been selected in the fluid menu.

INDEX NUMBER	MODE
0	Ideal gas
1	Calculation coefficients
2	van der Waals

Example:

Gas Calculation for Instrument number 01 is set at 1.

Host	SOHM01GBCRLF
Converter	SOHGB1CRLF

4.3.1.28 GN Instrument Number (For ABB use only.)

Interrogate the instrument number setting. This is a unique number for each instrument manufactured and must not be confused with the instrument address used for the ASCII communication.

4.3.1.29 I Pulse Factor

Interrogate the pulse factor setting. The units correspond to the units selected in the totalizer units menu (pulse / totalizer unit). This is a function of the operating mode selected, volume or mass (see 4.3.1.15 and 4.3.1.16). The output contains three decimal places.

Example:

Pulse Factor for Instrument number 01 is set at 100.

Host	SOHM01ICRLF
Converter	SOHI100CRLF

4.3.1.30 IA I_{out} at Alarm

Interrogate the current output value selection for an alarm condition.

INDEX NUMBER	OUTPUT VALUE
0	115%
1	0%

Example:

I_{out} at Alarm for Instrument number 01 is set at 1.

Host SOHM01ICRLF

Converter SOHI1CRLF

4.3.1.31 IB Pulse Width

Interrogate the pulse width setting. The output contains three decimal places.

Example:

Pulse Width for Instrument number 01 is set at 500.

Host SOHM01IBCRLF

Converter SOHIB500CRLF

4.3.1.32 IO Current Output

Interrogate the current output range selected.

INDEX NUMBER	CURRENT OUTPUT
0	0-20 mA
1	4-20 mA
2	0-10 mA
3	2-10 mA

Example:

Current Output for Instrument number 01 is set at 1.

Host SOHM01IOCRLF

Converter SOHIO1CRLF

4.3.1.33 K1-K7 k-Factor k1 to k7

Interrogate the k1 to k7 factor values. Only values for the number of point set in the k-linearization menu can be requested (average value or 2 to 7 points). The units are in the k-linearization units selected (see 4.3.1.18).

Example:

K-Factor for k1 for Instrument number 01.

Host	SOHM01K1CRLF
Converter	SOHK11CRLF

4.3.1.34 KL k-Linearization

Interrogate how many calibration points are to be used for the k-factors.

INDEX NUMBER	POINTS VALUE
0	Average Value
1	2 points
2	3 points
3	4 points
4	5 points
5	6 points
6	7 points

Example:

k-Linearization for Instrument number 01 is set at 3.

Host	SOHM01KLCRLF
Converter	SOHKL3CRLF

4.3.1.35 KM Average k-Factor

Interrogate the value of the average k-factor setting. This is only available when average value is selected in k-linearization menu. The units are those selected for k-factor units (see 4.3.1.18).

Example:

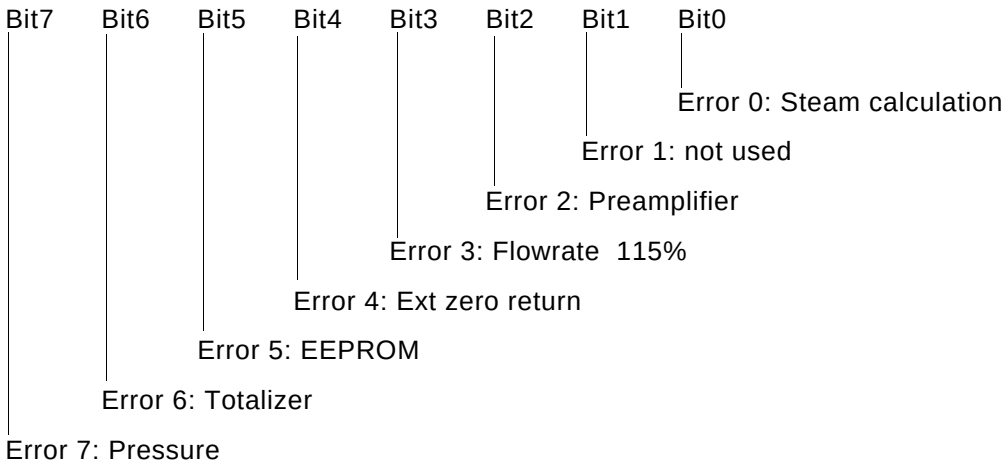
k-Factor for Instrument number 01 is set at 0.

Host	SOHM01KMCRLF
Converter	SOHKM0CRLF

4.3.1.36 L1 Log register 1

Interrogate log register 1. The bits correspond to those in the error register (see 4.3.1.21). In this log register all errors detected at any time are stored continuously. They are stored until erased with reset error command.

The eight bits of the error register are transmitted as eight ASCII characters ("0" = no error or "1" = error active) in the following format:



The contents of the log register are not modified by this interrogation. See also 4.3.1.37, log register 2.

Example:

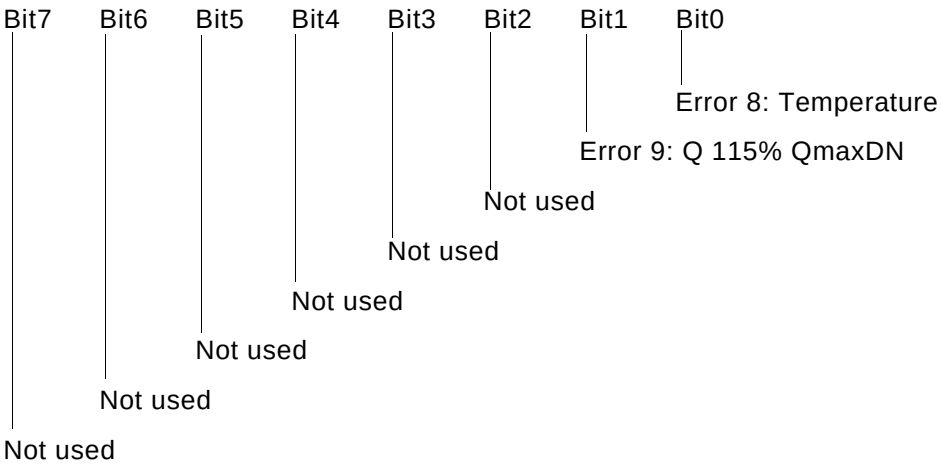
Read Log register 1 for instrument 01.

Host	SOHM01L1CRLF
Converter	SOHL10CRLF

4.3.1.37 L2 Log register 2

Interrogate log register 2. These bits correspond to those in the error register 2 (see 4.3.1.56). In this log register all errors detected at any time are stored continuously. They are stored until erased with reset error.

The eight bits of the error register are transmitted as eight ASCII characters ("0" = no error or "1" = error active) in the following format:



The contents of the log register are not modified by this interrogation. See also 4.3.1.36, logregister 1.

Example:

Read Log register 2 for instrument 01.

Host	SOHM01L2CRLF
Converter	SOHL20CRLF

4.3.1.38 MA Flowmeter Primary

Interrogate which flowmeter type has been selected.

INDEX NUMBER	FLOWMETER
0	Swirlmeter
1	Vortex meter

Example:

Flowmeter Primary for Instrument number 01 is set at 1.

Host SOHM01MACRLF

Converter SOHMA0CRLF

4.3.1.39 ME Fluid

Interrogate the fluid selected.

INDEX NUMBER	FLUID
0	Gas
1	Liquid
2	Superheated steam
3	Saturated steam

Example:

Fluid for Instrument number 01 is set at 1.

Host SOHM01MECRLF

Converter SOHME0CRLF

4.3.1.40 NA Mains Interrupt

Interrogate the number of mains interrupts. See also 4.1.37, error reset.

Example:

Read Mains Interrupt for Instrument number 01.

Host	SOHM01NACRLF
Converter	SOHNA0CRLF

4.3.1.41 ND Meter Size DDM (SwirlMeter)

Interrogate the swirlmeter size selected. This is only available when swirlmeter has been selected in the primary menu (see 4.3.1.38).

INDEX NUMBER	METER SIZE	
	inches	mm
0	½	15
1	¾	20
2	1	25
3	1¼	32
4	2	50
5	3	80
6	4	100
7	6	150
8	8	200
9	12	300
10	16	400

4.3.1.42 NI Adj Iout 4 mA (For ABB use only.)

Interrogate the 4 mA output current calibration value setting. The output contains three decimal places in mA.

4.3.1.43 NV Meter Size Vortex

Interrogate the vortex meter size selected. This is only available when vortex meter has been selected in the primary menu (see 4.3.1.38).

INDEX NUMBER	FLANGE CLASS	METER SIZE	
		inches	mm
0	DIN	1	25
1	DIN	1½	40
2	DIN	2	50
3	DIN	3	80
4	DIN	4	100
5	DIN	6	150
6	ANSI	1	25
7	ANSI	1½	40
8	ANSI	2	50
9	ANSI	3	80
10	ANSI	4	100
11	ANSI	6	150

Example:

Meter Size Vortex for Instrument number 01 is set at 2.

Host SOHM01NVCRLF

Converter SOHNV2CRLF

4.3.1.44 NZ Normal Conditions

Interrogate which normal conditions have been selected. This is only available when gas has been selected in the fluid menu.

INDEX NUMBER	DEFINITION
0	1.0133 bar absolute @ 0^{o} C
1	1.0133 bar absolute @ 20^{o} C

Example:

Normal Conditions for Instrument number 01 is set at 1.

Host SOHM01NZCRLF

Converter SOHNZ1CRLF

4.3.1.45 PO Pressure 0%

Interrogate the value of the 0% absolute pressure set for the pressure input. Example: Pressure transmitter 5 to 10 bar absolute with 4 - 20 mA output signal.

→ 4 mA <=> 0% <=> 5 bar absolute

The output contains three decimal places in the selected pressure units (see 4.3.1.20, 4.4.1.20).

Example:

Pressure 0% for Instrument number 01 is set at 0.

Host	SOHM01POCRLF
Converter	SOHPO0CRLF

4.3.1.46 P1 Pressure 100%

Interrogate the value of the 100% absolute pressure set for the pressure input. Example: Pressure transmitter 5 to 10 bar absolute with 4 - 20 mA output signal.

→ 20 mA <=> 100% <=> 10 bar absolute.

The output contains three decimal places in the selected pressure units (see 4.3.1.20, 4.4.1.20).

Example:

Pressure 100% for Instrument number 01 is set at 0.

Host	SOHM01P1CRLF
Converter	SOHP10CRLF

4.3.1.47 PI Pressure Input

Interrogate the current range selected for the pressure input.

INDEX NUMBER	CURRENT OUTPUT
0	0-20 mA
1	4-20 mA
2	0-10 mA
3	2-10 mA

Example:

Pressure Input for Instrument number 01 is set at 1.

Host SOHM01PICRLF

Converter SOHPI1CRLF

4.3.1.48 PK Constant Pressure

Interrogate whether a constant pressure has been programmed in the converter when measure pressure has been selected. The units are the same as the pressure units selected (see 4.3.1.20 and 4.4.1.20). The interrogation is only available if:

1) the pressure measurement is turned on
2) saturated steam has not been selected in the Fluid Menu 3.15

Example:

Constant Pressure for Instrument number 01 is set at 0.

Host SOHM01PKCRLF

Converter SOHPK0CRLF

4.3.1.49 PM Measure Pressure

Interrogate whether measure pressure is turned on or off. This is only available when saturated steam has not been selected in the fluid menu together with measure temperature in the saturated steam menu.

INDEX NUMBER	MODE
0	off
1	on

Example:

Measure Pressure for Instrument number 01 is set at 0.

Host SOHM01PMCRLF

Converter SOHPM0CRLF

4.3.1.50 PR Firmware Version

Interrogate the converter firmware version. The output has the following format:

B095 A31

The first portion is a part of the ABB part number for the EEPROM: D699**B095**U01

The second portion indicates the firmware revision level: **A.31**

Example:

Read Firmware Version for Instrument number 01.

Host	SOHM01PRCRLF
Converter	SOHPRB095A.31CRLF

4.3.1.51 PN Adjust I_{in} 4 mA

Interrogate the 4 mA current input (= pressure input) calibration value setting. The output contains three decimal places in mA.

Example:

Adjust I_{in} 4 mA for Instrument number 01 is set at 1.

Host	SOHM01PNCRLF
Converter	SOHPN1CRLF

4.3.1.52 PS Adjust I_{in} 20 mA

Interrogate the 20 mA current input (= pressure input) calibration value setting. The output contains three decimal places in mA.

Example:

Adjust I_{in} 4 mA for Instrument number 01 is set at 1.

Host	SOHM01PSCRLF
Converter	SOHPS1CRLF

4.3.1.53 Q> Q_{max} Mode

Interrogate the Q_{max} value setting. This value corresponds to 100% flowrate in the selected operating mode (see 4.3.1.19). The units are a function of the operating mode selected. For operating modes actual and standard, Q_{max} has the volumetric flowrate units selected (see 4.3.1.13); for operating mode mass Q_{max} has the gravimetric flowrate units selected (see 4.3.1.14).

Example:

Q_{max} Mode for Instrument number 01 is set at 1.

Host	SOHM01Q>CRLF
Converter	SOHQ>1CRLF

4.3.1.54 QM Q_{min} Actual

Interrogate the Q_{min} value setting. This value corresponds to the low flow cutoff value. When the flowrate decreases below Q_{min} it is set to 0. The units are the volumetric flowrate units selected (see 4.3.1.13).

Example:

Q_{min} Actual for Instrument number 01 is set at 1.

Host	SOHM01QMCRLF
Converter	SOHQM1CRLF

4.3.1.55 QN Q_{max}DN Actual

Interrogate the maximum actual flowrate of the primary. The units are the volume flowrate units selected (see 4.3.1.13).

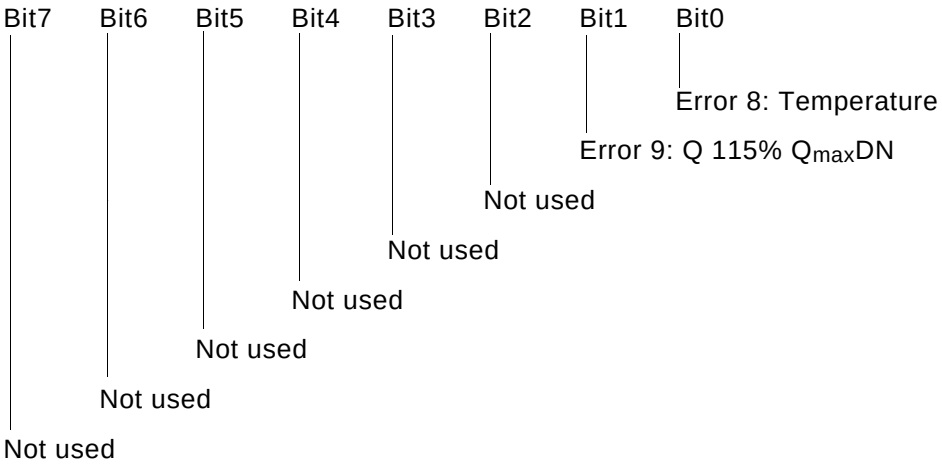
Example:

Q_{max} DN Actual for Instrument number 01 is set at 1.

Host	SOHM01QNCRLF
Converter	SOHQN1RLF

4.3.1.56 R2 Error Register 2

Interrogate the second half of the error register. This register contains information about the presently active errors, i.e. the errors which are signalled over the alarm contacts of the converter.



The error register is not altered by the interrogation. See 4.3.1.21, 4.3.1.36, error register.

Example:

Read Error Register 2 for instrument 01.

Host	SOHM01R2CRLF
Converter	SOHR20CRLF

4.3.1.57 SD Saturated Steam

Interrogate whether pressure or temperature is being used for saturated steam measurements. Prerequisite is that saturated steam has been selected in the fluid menu.

INDEX NUMBER	MEASURED VALUE
0	Measure temperature
1	Measure pressure

Example:

Saturated Steam for Instrument number 01 is set at 1.

Host	SOHM01SDCRLF
Converter	SOHSD1CRLF

4.3.1.58 SI Adjust I_{out} 20 mA (For ABB use only.)

Interrogate the calibration value setting for the 20 mA current output. The output contains three decimal places in mA.

4.3.1.59 SP Language

Interrogate the language selected.

INDEX NUMBER	LANGUAGE
0	German
1	English

Example:

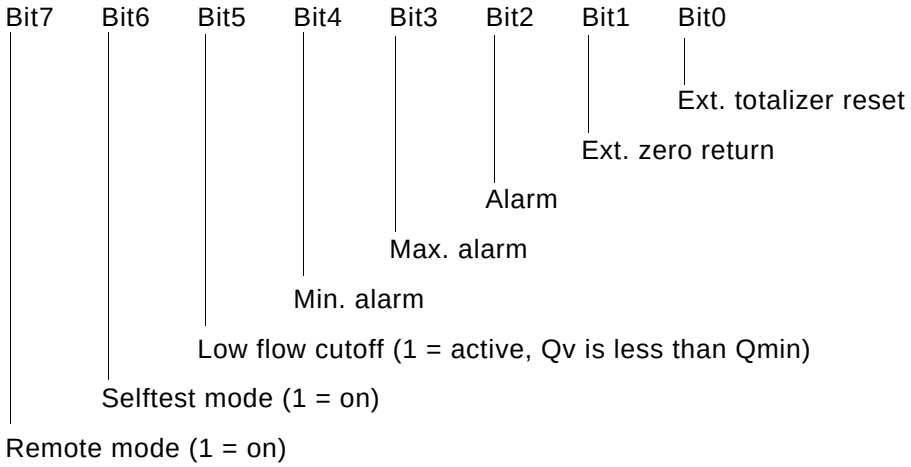
Language for Instrument number 01 is set at 1.

Host	SOHM01SPCRLF
Converter	SOHSP1CRLF

4.3.1.60 ST Status Register

Interrogate the error register. This register contains information about the instantaneous condition of the converter.

The eight bits of the error register are transmitted as eight ASCII characters (’0’ = no error or "1" active error) in the following format:



Example:

Read Status Register for instrument 01.

Host	SOHM01STCRLF
Converter	SOHST0CRLF

4.3.1.61 TK Constant Temperature

Interrogate whether a constant temperature has been programmed in the converter when measure temperature has been selected. The units are the same as the temperature units selected (see 4.3.1.19, 4.4.1.19). The interrogation is only available if:

1) the temperature measurement is turned on
2) saturated steam has not been selected in the fluid menu (3.15).

Example:

Constant Temperature for Instrument number 01 is set at 1.

Host	SOHM01TKCRLF
Converter	SOHTK1CRLF

4.3.1.62 TM Measure Temperature

Interrogate whether measure temperature is turned on or off. This is only available when saturated steam has not been selected in the fluid menu (3.15).

INDEX NUMBER	MODE
0	off
1	on

Example:

Measure Temperature for Instrument number 01 is set at 1.

Host	SOHM01TMCRLF
Converter	SOHTM1CRLF

4.3.1.63 VA van der Waals Constant a

Interrogate the value of the van der Waals constant a setting. The units are $l^2 \bullet atm/mole^2$. Prerequisite is:

1) gas has been selected in the fluid menu (3.15)
2) van der Waals has been selected in the gas calculation menu

Example:

van der Waals Constant a for Instrument number 01 is set at 10.

Host	SOHM01VACRLF
Converter	SOHVA10CRLF

4.3.1.64 VB van der Waals Constant b

Interrogate the value of the van der Waals constant b setting. The units are l/mole. Prerequisite is:

1) gas has been selected in the fluid menu (3.15)
2) van der Waals has been selected in the gas calculation menu

Example:

van der Waals Constant b for Instrument number 01 is set at 10.

Host	SOHM01VBCRLF
Converter	SOHVB10CRLF

4.3.1.65 VK Volume Expansion

Interrogate the value of the volume expansion coefficient for liquids. The units are percent/degree Celsius. Prerequisite is:

1) liquid has been selected in the fluid menu (3.15)

Example:

Volume Expansion for Instrument number 01 is set at 10.

Host	SOHM01VKCRLF
Converter	SOHVK10CRLF

4.3.1.66 VT Gas Table for van der Waals

Interrogate the gas selected for the van der Waals gas calculation. Number 22 indicates that the van der Waals coefficients a and/or b do not correspond to a gas contained in the list.

INDEX NUMBER	GAS	SYMBOL
0	Oxygen	O_2
1	Nitrogen	N_2
2	Helium	He
3	Hydrogen	H_2
4	Argon	A
5	Neon	Ne
6	Chlorine	Cl_2
7	Carbon monoxide	CO
8	Carbon dioxide	CO_2
9	Sulfur dioxide	SO_2
10	Nitrous oxide	NO
11	Ammonia	NH_3
12	Hydrogen chloride	HC1
13	Hydrogen sulfide	H_2S
14	Methane	CH_4
15	Acetylene	C_2H_2
16	Ethylene	C_2H_4
17	Ethane	C_2H_6
18	Propylene	C_3H_6
19	Propane	C_3H_8
20	Benzine	C_6H_6
21	Butane ¯n	C_6H_{10}
22	---	

Gas Table for van der Waals for Instrument number 01 is set at 0.

Host	SOHM01VTCRLF
Converter	SOHVT0CRLF

4.3.1.67 Measurement Values

Some of the measurement values which can be displayed on the converter can be interrogated using the following codes.

4.3.1.67.1 Md Percent

Interrogate the value of the flowrate in percent. The flowrate corresponds to the actual, standard or mass flowrate selected in the operating mode menu. 100% corresponds to Q_{max}.

Example:

Percent for Instrument number 01 is set at 10.

Host	SOHM01MDCRLF
Converter	SOHMD10CRLF

4.3.1.67.2 Fr Frequency

Interrogate the instantaneous frequency value in Hz.

Example:

Frequency for Instrument number 01 is set at 100.

Host	SOHM01FRCRLF
Converter	SOHMFR100CRLF

4.3.1.67.3 Pr Pressure

Interrogate the instantaneous absolute pressure value. The units are the selected pressure units (see 4.3.1.20, 4.4.1.20).

Example:

Pressure for Instrument number 01 is set at 1.

Host	SOHM01PRCRLF
Converter	SOHMPR1CRLF

4.3.1.67.4 Qm Mass Flowrate

Interrogate the instantaneous mass flowrate value. The units are the selected gravimetric flowrate units (see 4.3.1.14).

Example:

Qm Mass Flowrate for Instrument number 01 is set at 1.

Host	SOHM01QmCRLF
Converter	SOHMQm1CRLF

4.3.1.67.5 Qv Normal Flowrate

Interrogate the instantaneous Normal flowrate value. The units are the selected volumetric flowrate units (see 4.3.1.13). When saturated or superheated steam are selected in the fluid menu the value is always 0.

Example:

Qv Normal Flowrate for Instrument number 01 is set at 1.

Host	SOHM01QvCRLF
Converter	SOHMQv1CRLF

4.3.1.67.6 Qv Actual Flowrate

Interrogate the instantaneous actual flowrate value. The units are the selected volumetric flowrate units (see 4.3.1.13).

Example:

Qv Actual Flowrate for Instrument number 01 is set at 1.

Host	SOHM01QvCRLF
Converter	SOHMQv1CRLF

4.3.1.67.7 Te Temperature

Interrogate the instantaneous temperature value. The units are the selected temperature units (see 4.3.1.19, 4.4.1.19).

Example:

Temperature for Instrument number 01 is set at 1.

Host	SOHM01TECRLF
Converter	SOHMTE1CRLF

4.3.1.67.8 ZA Totalizer Value

Interrogate the instantaneous totalizer value. The totals correspond to the actual, standard, or mass flowrate selected in the operating mode menu. In the actual or standard mode the totalizer units are the selected volumetric units (see 4.3.1.15). In the mass mode the totalizer units are the selected gravimetric units (see 4.3.1.16).

Example:

Totalizer Value for Instrument number 01 is set at 1.

Host	SOHM01ZACRLF
Converter	SOHMZA1CRLF

4.3.1.67.9 ZU Overflow Counter

Interrogate the number of totalizer overflows. The totalizer overflows when it reaches 10 million units.

Example:

Overflow Counter for Instrument number 01 is set at 1.

Host	SOHM01ZUCRLF
Converter	SOHMZU1CRLF

4.3.1.68 Function Test

NOTE
Before interrogating the test functions the converter must be switched to the function test mode. After conclusion of the function tests the function test mode must be turned off.

When the converter is in the function test mode, the output signals (current output, pulse output, alarm, min. and max. alarm contacts) are no longer functional. They remain at the values which existed when the function test mode was turned on or the values to which they were set during the function test procedure. Only after the function test mode has been turned off will the outputs become functional, i.e., correspond to the flowrate.

The function test mode is turned on by

1) the ASCII command %1 (see 4.4.1.67.2)
2) entering the function test submenu

The function test mode is turned off by

1) the ASCII command %0 (see 4.4.1.67.1)
2) exiting the function test submenu

4.3.1.68.1 %4 Function Test EPROM

Test the EPROM. Test duration approximately 10 seconds. Response from converter:

0 EPROM ok

1 EPROM defective

Example:

Interogate the %4 Function Test EPROM for Instrument 01.

Host	SOHM01%4CRLF
Converter	SOHM%40CRLF

4.3.1.68.2 %5 Function Test NVRAM

Test the NVRAM. Test duration approximately 0.5 seconds. Response from converter:

0 NVRAM ok

1 NVRAM defective

Example:

Interogate the %5 Function Test NVRAM for Instrument 01.

Host	SOHM01%5CRLF
Converter	SOHM%50CRLF

4.3.1.68.3 %6 Function Test EEPROM

Test the EEPROM. Test duration approximately 5 seconds. Response from converter:

0	EEPROM ok
1	EEPROM defective

Example:

Interogate the %6 Function Test EEPROM for Instrument 01.

Host	SOHM01%6CRLF
Converter	SOHM%60CRLF

4.3.1.68.4 %A Function Test External Zero Return

Interrogate the external zero return input. Response from the converter:

0	Input passive
1	Input active

Example:

Interogate the %A Function Test External Zero Return for Instrument 01.

Host	SOHM01%ACRLF
Converter	SOHM%A0CRLF

4.3.1.68.5 %B Function Test External Totalizer Reset

Interrogate the external totalizer reset input. Response from the converter:

0	Input passive
1	Input active

Example:

Interogate the %B Function Test External Totalizer Reset for Instrument 01.

Host	SOHM01%BCRLF
Converter	SOHM%B0CRLF

4.3.1.68.6 %I Function Test RAM

Test the RAMs. Test duration approximately 1 second. Response from the converter:

0	RAM ok
1	RAM defective

Example:

Interogate the %I Function Test RAM for Instrument 01.

Host	SOHM01%ICRLF
Converter	SOHM%I0CRLF

4.3.1.68.7 %J Function Test External EEPROM

Test the external EEPROM. Test duration approximately 5 seconds. Response from converter:

0	Ext. EEPROM ok
1	Ext. EEPROM defective

Example:

Interogate the %J Function Test External EEPROM for Instrument 01.

Host	SOHM01%JCRLF
Converter	SOHM%J0CRLF

4.3.1.68.8 %K Function Test Keypad

Test the keypad. Response from the converter.

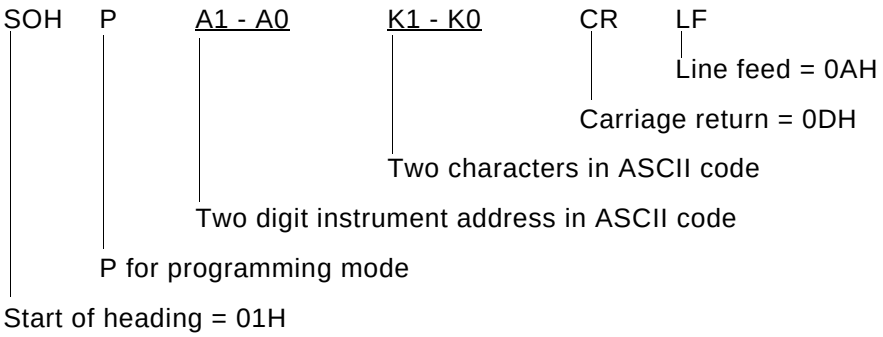
INDEX NUMBER	KEYPAD CHARACTER
0	Key 0 pressed
1	Key 1 pressed
2	Key 2 pressed
3	Key 3 pressed
4	Key 4 pressed
5	Key 5 pressed
6	Key 6 pressed
7	Key 7 pressed
8	Key 8 pressed
9	Key 9 pressed
.	Key dot pressed
-	Key - pressed
^	Key cursor up pressed
v	Key cursor down pressed
E	Key ENTER pressed
C	Key C/CE pressed
X	No key pressed

4.4 Programming Mode

The Programming Mode can be used to either enter new parameters or perform menu functions. This accomplished with the aid of character codes. The host computer addresses the converter as follows:

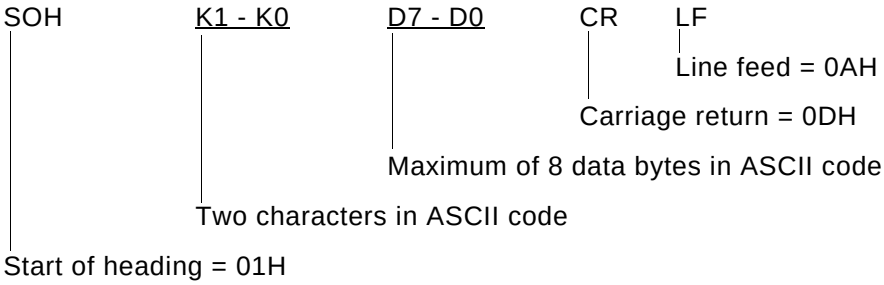
1) Command from host computer.

Host computer → converter



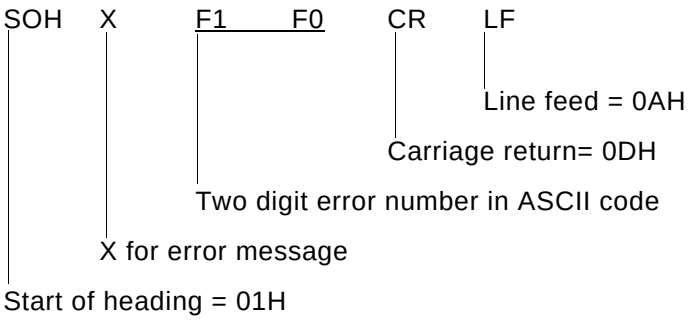
2) Response from converter.

Converter → host computer



The entry of the instrument address must always contain two digits.

A maximum of 8 data bytes can be transmitted to the converter. **If this number is exceeded or an incorrect entry made the following message is transmitted by the converter to the communicating device:**



4.4.1 Program Mode Codes

4.4.1.1 A1 Display Line 1

Program the first line of the display.

INDEX NUMBER	PROGRAM MODE
0	Qv actual
1	Qn standard
2	Qm mass
3	Percent
4	Percent bar graph
5	Totalizer
6	Pressure
7	Temperature
8	Pressure + temperature
9	Frequency
10	Freq undamped (*)
11	Freq measurement (*)
12	Freq jitter (*)
13	A/D Treference (*)
14	A/D Tmeasured (*)
15	A/D Pmeasured (*)

(*) For ABB use only

Error Number	Cause
42	Entry> 15 Entry 9 and access to (*) without code number

Example:

Display Line 1 for instrument number 01 is programmed at 5.

Host	SOHP01A15CRLF
Converter	SOHA15CRLF

4.4.1.2 A2 Display Line 2

Program the second line of the display (see 4.4.1.1).

Example:

Display Line 2 for instrument number 01 is programmed at 5.

Host	SOHP01A25CRLF
Converter	SOHA25CRLF

4.4.1.3 A3 Display Line 2 Multiplex

Program the additional value to be displayed in the second line in the multiplex mode (see 4.4.1.1).

Example:

Display Line 2 Multiplex for instrument number 01 is programmed at 5.

Host	SOHP01A35CRLF
Converter	SOHA35CRLF

4.4.1.4 AK Correction Coefficient

Program the correction coefficients for the gas calculation. This is only available when:

1) gas is selected in the fluid parameter (see 4.3.1.39)
2) correction coefficient is selected in the gas calculation parameter (see 4.3.1.27)

The correction coefficients are dimensionless. The output contains three decimal places.

Example:

Correction Coefficient for instrument number 01 is programmed at 1.

Host	SOHP01AK1CRLF
Converter	SOHAK1CRLF

4.4.1.5 AM Multiplex

Program if the multiplex mode for measurement displays is turned on.

INDEX NUMBER	MODE
0	off
1	on

Example:

Multiplex for instrument number 01 is turned on.

Host SOHP01AM1CRLF

Converter SOHAM1CRLF

4.4.1.6 AN Minimum Alarm

Program the threshold setting for the minimum alarm. The output is in percent.

Example:

Minimum Alarm for instrument number 01 is programmed at 10%.

Host SOHP01AN10CRLF

Converter SOHAN10CRLF

4.4.1.7 AX Maximum Alarm

Program the threshold setting for the maximum alarm. The output is in percent.

Example:

Maximum Alarm for instrument number 01 is programmed at 90%.

Host SOHP01AX90CRLF

Converter SOHAX90CRLF

4.4.1.8 BA Baudrate

Program the baudrate of the serial data link. After a correct entry is made the new baudrate will appear. If an incorrect index number is entered, error number 57 will appear.

INDEX NUMBER	BAUDRATE
0	110
1	300
2	600
3	1200
4	2400
5	4800
6	9600
7	14400
8	19200
9	28800

Error Number	Cause
57	Entry> 9

Example:

Buad rate for instrument number 01 is programmed at 1200

Host	SOHP01BA3CRLF
Converter	SOHBA3CRLF

4.4.1.9 BE Operating Mode

Program the operating mode of the converter. The normal mode can only be selected when gas or liquid has been selected in the fluid menu (3.15).

INDEX NUMBER	MODE
0	Actual
1	Normal
2	Mass

Error Number	Cause
19	Entry> 2 Entry = 1 for saturated or superheated steam

Example:

Operating mode for instrument number 01 is programmed at 1

Host	SOHP01BE1CRLF
Converter	SOHBE1CRLF

4.4.1.10 DI Normal Density

Program the normal density. This is only available when gas or liquid has been selected in the fluid menu. The units are those selected in the density units menu (see 4.4.1.17)

Data range: 0.0 ≤ entry value ≤ 10 g/cm3 or upper range limit converted to other units, e.g. 10000 kg/m3

Error Number	Cause
29	Entry outside of data range

Example:

Instrument number 01 is programmed for 0.8 g/cm^3 density.

Host	SOHP01DI0.08CRLF
Converter	SOHDI0.8CRLF

4.4.1.11 DP Damping

Program the damping in seconds. This represents the time it takes the converter to move to 63% of its final value after a step flow change.

Data range: 0.2 ≤ entry value ≤ 100.0

Error Number	Cause
39	Entry outside of data range

Example:

Instrument number 01 is programmed at 12 seconds damping.

Host	SOHP01DP12CRLF
Converter	SOHDP12CRLF

4.4.1.12 DT Printer Type

Program the printer type for data output.

INDEX NUMBER	PRINTER
0	Standard
1	ABB Docuprint
2	Standard CR LF

Error Number	Cause
59	Entry > 3

Example:

Instrument number 01 is programmed for printer 2.

Host	SOHP01DT2CRLF
Converter	SOHDT2CRLF

4.4.1.13 E1 Units Qv

Program the volumetric flowrate units for $Q_{max}DN$, Q_{max} (only for actual and standard operating modes), Q_{min} as well as for the display of the actual (Qv) or normal (Qn) flowrates. All values are converted to the new units. (Example: 1 l/s → 3.6 m^3/h).

INDEX NUMBER	ABBREVIATION
0	l/s
1	l/m
2	l/h
3	m^3/s
4	m^3/m
5	m^3/h
6	m^3/d
7	ft^3/s
8	$ft^{3/}$m
9	ft^3/h
10	ft^3/d
11	usgps
12	usgpm
13	usgph
14	usmgd
15	igps
16	igpm
17	igph
18	igpd
19	bbl/s
20	bbl/m
21	bbl/h
22	bbl/d

Error Number	Cause
30	Entry > 22

Example:

Units Qv for instrument number 01 is programmed at 1

Host	SOHP01E11CRLF
Converter	SOHE11CRLF

4.4.1.14 E2 Units Qm

Program the gravimetric flow units for Q_{max} (only mass operating mode) as well as well as for the display of the mass (Qm) flowrate. All values are converted to the new units.
(Example: 1 kg/s → 3600 kg/h).

INDEX NUMBER	ABBREVIATION
0	g/s
1	g/m
2	g/h
3	kg/s
4	kg/m
5	kg/h
6	kg/d
7	t/m
8	t/h
9	t/d
10	lb/s
11	lb/m
12	lb/h
13	lb/d

Error Number	Cause
31	Entry > 13

Example:

Units Qm for instrument number 01 is programmed at 1

Host	SOHP01E21CRLF
Converter	SOHE21CRLF

4.4.1.15 E3 Units Totalizer

Program the totalizer volumetric units. Only available when actual or standard has been selected in the operating mode menu. When the units are changed all values are converted to the new units including the overflow register value.

INDEX NUMBER	UNIT
0	l
1	m^3
2	ft^3
3	usgal
4	igal
5	bbl

Error Number Cause

35 Entry > 5

Example:

Units Totalizer for instrument number 01 is programmed at 1

Host SOHP01E31CRLF

Converter SOHE31CRLF

4.4.1.16 E4 Units Totalizer

Program the totalizer gravimetric units. Only available when mass has been selected in the operating mode menu. When the units are changed all values are converted to the new units including the overflow register value.

INDEX NUMBER	ABBREVIATION
0	g
1	kg
2	t (metric)
3	lb

Error Number Cause

36 Entry > 3

Example:

Units Totalizer for instrument number 01 is programmed at 1

Host SOHP01E41CRLF

Converter SOHE41CRLF

4.4.1.17 E5 Units Density

Program the density units. Only available when actual or standard has been selected in the operating mode menu. When the units are changed the density value is converted to the new units. (Example: 1 kg/l → 1000 kg/m3)

INDEX NUMBER	ABBREVIATION
0	g/ml
1	g/cm^3
2	g/l
3	kg/l
4	kg/m^3
5	lb/ft^3
6	lb/usgal

Error Number	Cause
28	Entry > 6

Example:

Units Density for instrument number 01 is programmed at 1

Host	SOHP01E51CRLF
Converter	SOHE51CRLF

4.4.1.18 E6 Units k-Factor

Program the units for the k-Factor. The k-Factors are automatically converted to the new units. (Example: 1000 pulse/m3 → 28.317 pulses/ft3)

INDEX NUMBER	ABBREVIATION
0	$1/m^3$
1	$1/ft^3$

Error Number	Cause
15	Entry > 1

Example:

Units k-Factor for instrument number 01 is programmed at 1

Host	SOHP01E61CRLF
Converter	SOHE61CRLF

4.4.1.19 E7 Units Temperature

Program the units for the temperature. The temperature is automatically converted to the new units. (Example: 20^o C → 68^o F)

INDEX NUMBER	ABBREVIATION
0	0^o C (Degrees Celsius)
1	0^o F (Degrees Fahrenheit)

Error Number	Cause
15	Entry > 1

Example:

Units Temperature for instrument number 01 is programmed at 1

Host	SOHP01E71CRLF
Converter	SOHE71CRLF

4.4.1.20 E8 Units Pressure

Program the units for the pressure. The pressure is automatically converted to the new units. (Example: 1.013 bara →14.697 PSIA)

INDEX NUMBER	ABBREVIATION
0	bara (bar absolute)
1	PSIA (PSI absolute)

Error Number	Cause
66	Entry > 1

Example:

Units Pressure for instrument number 01 is programmed at 1

Host	SOHP01E81CRLF
Converter	SOHE81CRLF

4.4.1.21 Frequency f1 to f7

Program the frequencies f1 to f7 for the k-linearization. The number of values to be entered must be the same as the number of points set in the k-Linearization menu (average value or 2 to 7). The units are Hz. All frequencies must be less than 2500 Hz. Only whole numbers may be entered (zero decimal places).

f1: $1 \leq$ entry value $\leq$ f2
f2: f1 $\leq$ entry value $\leq$ f3
f3: f2 $\leq$ entry value $\leq$ f4
f4: f3 $\leq$ entry value $\leq$ f5
f5: f4 $\leq$ entry value $\leq$ f6
f6: f5 $\leq$ entry value $\leq$ f7
f7: f6 $\leq$ entry value $\leq$ 2500

Error Number	Cause
18	Entry outside of data range

Example:

Frequency f1 for instrument number 01 is programmed at 1

Host	SOHP01F11CRLF
Converter	SOHF11CRLF

4.4.1.22 FH Frequency Hold Time

Program the holding time for the last measured frequency after a frequency signal loss. The units are in seconds.

Data range: 0.1 ≤ entry value ≤ 10.0

Error Number	Cause
55	Entry outside of data range

Example:

Frequency Hold Time for instrument number 01 is programmed at 3

Host	SOHP01FH3CRLF
Converter	SOHFH3CRLF

4.4.1.23 FK Frequency Correction (For ABB use only.)

Program the frequency correction mode. This feature corrects the errors, which are caused by the jitter of the measurement frequency period.

0	off
1	on

Error Number	Cause
64	Entry >1

4.4.1.24 FN Minimum Frequency

Program the minimum frequency, i.e. the lower frequency search limit. The units are in Hz. Only whole numbers can be entered.

Data range: 1 ≤ Entry value ≤ maximum frequency/2

Error Number	Cause
53	Entry outside of data range

Example:

Minimum Frequency for instrument number 01 is programmed at 100

Host	SOHP01FN100CRLF
Converter	SOHFN100CRLF

4.4.1.25 FX Maximum Frequency

Program the maximum frequency, i.e. the upper frequency search limit. The units are in Hz. Only whole numbers can be entered.

Data range: minimum frequency ≤ Entry value ≤ 2500

Error Number	Cause
54	Entry outside of data range

Example:

Maximum Frequency for instrument number 01 is programmed at 2500

Host	SOHP01FN2500CRLF
Converter	SOHFN2500CRLF

4.4.1.26 GA Instrument Address

Program the instrument address for the ASCII communication. When no error message appears the converter can be subsequently addressed by the ASCII Protocol with the new address. If an error is detected the old address is maintained.

Data range: 0 ≤ Entry value ≤ 99

Error Number	Cause
58	Entry outside of data range

4.4.1.27 GB Gas Calculation

Program the type of gas calculation to be made. This is only available when gas has been selected in the fluid menu.

INDEX NUMBER	SELECTION
0	Ideal gas
1	Calculation coefficients
2	van der Waals

Error Number	Cause
20	Entry > 2

Example:

Gas Calculation for instrument number 01 is programmed at 1

Host	SOHP01GB1CRLF
Converter	SOHGB1CRLF

4.4.1.28 GN Instrument Number (For ABB use only.)

Program the instrument number. This is a unique number for each instrument manufactured and must not be confused with the instrument address used for the ASCII communication.

Data range: 0 ≤ Entry value ≤ 65535

Error Number	Cause
61	Entry outside of data range

4.4.1.29 I> Pulse Factor

Program the pulse factor. The units correspond to the units selected in the totalizer units menu (pulses/totalizer unit). This is a function of the operating mode selected, volume or mass. The totalizer value is not changed because the converter internally counts the actual number of pulses while here only their weight is changed.

Data range: 0.001 ≤ Entry value ≤ 1000.0

Error Number	Cause
61	Entry outside of data range

Example:

Pulse Factor for instrument number 01 is programmed at 100

Host	SOHP01P>100CRLF
Converter	SOHP>100CRLF

4.4.1.30 IA I_{out} at Alarm

Program the output current value during an alarm condition.

INDEX NUMBER	CURRENT VALUE
0	115%
1	0%

Error Number	Cause
45	Entry > 1

Example:

I_{out} at Alarm for instrument number 01 is programmed at 1

Host	SOHP01IA1CRLF
Converter	SOHIA1CRLF

4.4.1.31 IB Pulse Width

Program the pulse width for the pulse output. The units are milliseconds. **The pulse width must be less than the minimum time between two pulses!**

Data range: 0.016 ≤ Entry value ≤ 1000

Error Number	Cause
38	Entry outside of data range

Example:

Pulse Width for instrument number 01 is programmed at 500

Host	SOHP01IB500CRLF
Converter	SOHIB500CRLF

4.4.1.32 IO Current Output

Program the current output range

INDEX NUMBER	CURRENT OUTPUT
0	0 - 20 mA
1	4 - 20 mA
2	0 - 10 mA
3	2 - 10 mA

Error Number	Cause
44	Entry > 3

Example:

Current Output for instrument number 01 is programmed at 1

Host	SOHP01IO1CRLF
Converter	SOHIO1CRLF

4.4.1.33 k-Factor k1 to k7

Program the k-Factors k1 to k7 for the k-linearization. The number of values to be entered must be the same as the number of points set in the k-linearization menu (average value or 2 to 7). The units are those selected in k-linearization units menu (see 4.4.1.18).

Data range:

$1.0 \quad 1/m^3 \leq$ Entry value $\leq 1000000 \quad 1/m^3$
$0.028\ 1/ft^3 \leq$ Entry value $\leq 28317\ 1/ft^3$

Error Number	Cause
17	Entry outside of data range

Example:

k-Factor k1 for instrument number 01 is programmed at 1

Host	SOHP01K11CRLF
Converter	SOHK11CRLF

4.4.1.34 KL k-Linearization

Program the number of points to be used for the k-linearization.

INDEX NUMBER	POINTS
0	Average value
1	2 points
2	3 points
3	4 points
4	5 points
5	6 points
6	7 points

Error Number	Cause
16	Entry >5

Example:

k-Linearization for instrument number 01 is programmed at 3

Host	SOHP01KL3CRLF
Converter	SOHKL3CRLF

4.4.1.35 KM Average k-Factor

Program the value for the average k-factor. This is only available when average value is selected in k-linearization menu. The units are those selected for k-factor units.

Data range:

$1.0\ 1/m^3 \leq$ Entry value $\leq 1000000\ \ 1/m^3$
$0.028\ 1/ft^3 \leq$ Entry value $\leq 28317\ \ 1/ft^3$

Error Number	Cause
17	Entry outside of data range

Example:

Average k-Factor for instrument number 01 is programmed at 0

Host	SOHP01KM0CRLF
Converter	SOHKM0CRLF

4.4.1.36 KN Code Number

Access to the calibration parameters is achieved by entering the proper code number. The calibration mode is locked out without entry of the proper code number. Refer to 3.43.

Data range: $0 \leq$ Entry value 9999

Error Number	Cause
60	Entry outside of data range

4.4.1.37 LF Error Reset

This parameter is used to reset the error and mains interrupt registers.

Data bytes: none

4.4.1.38 LZ Totalizer Reset

This parameter is used to reset the totalizer and overflow registers.

Data bytes: none

4.4.1.39 MA Flowmeter

Program the flowmeter type.

INDEX NUMBER	FLOWMETER
0	Swirlmeter
1	Vortex Meter

Error Number	Cause
11	Error > 1

Example:

Flowmeter for instrument number 01 is programmed at 1

Host	SOHP01MA1CRLF
Converter	SOHMA1CRLF

4.4.1.40 ME Fluid

Program the fluid.

INDEX NUMBER	FLUID
0	Gas
1	Liquid
2	Superheated steam
3	Saturated steam

Error Number	Cause
12	Entry > 3

Example:

Fluid for instrument number 01 is programmed at 1

Host	SOHP01ME1CRLF
Converter	SOHME1CRLF

4.4.1.41 ND Meter Size DDM (Swirlmeter)

Program the swirlmeter size. This is only available when swirlmeter has been selected in the flowmeter primary menu.

INDEX NUMBER	METER SIZE	
	inches	mm
0	½	15
1	¾	20
2	1	25
3	1¼	32
4	2	50
5	3	80
6	4	100
7	6	150
8	8	200
9	12	300
10	16	400

Error Number	Cause
13	Entry > 10

4.4.1.42 NI Adj I_{out} 4 mA (For ABB use only.)

Program the calibration value for the 4 mA current output. The units are mA.

Data range: $2 \leq$ Entry value ≤ 6

Error Number	Cause
62	Entry outside of data range

4.4.1.43 NV Meter Size (Vortex Meter)

Program the Vortex meter size. **This is only available when vortex meter has been selected in the flowmeter primary menu.**

Enter the applicable **ANSI** meter size. Only the menu choices in the following **ANSI table** is applicable to meters built in the US by ABB Inc.. DIN meter values are not applicable to meters built in the US. Entering a DIN size will cause discrepancies in metering values caused by pipe area differences in ANSI and DIN standards.

INDEX NUMBER	FLANGE CLASS	METER SIZE	
		inches	mm
0	DIN	1	25
1	DIN	1½	40
2	DIN	2	50
3	DIN	3	80
4	DIN	4	100
5	DIN	6	150
6	ANSI	1	25
7	ANSI	1½	40
8	ANSI	2	50
9	ANSI	3	80
10	ANSI	4	100
11	ANSI	6	150

Error Number	Cause
14	Entry > 11

Example:

Meter Size (Vortex Meter) for instrument number 01 is programmed at 2

Host	SOHP01NV2CRLF
Converter	SOHNV2CRLF

4.4.1.44 NZ Normal Conditions

Program the normal conditions for gas measurements. **This is only available when gas has been selected in the fluid menu.**

INDEX NUMBER	CONDITION
0	1.0133 bar absolute 0^{o} C
1	1.0133 bar absolute 20^{o} C

Error Number	Cause
25	Entry > 1

Example:

Normal Conditions for instrument number 01 is programmed at 1

Host	SOHP01NZ1CRLF
Converter	SOHNZ1CRLF

4.4.1.45 PO Pressure 0%

Program the value of the 0% absolute pressure at the pressure input. The units are those selected in the pressure units menu (see 4.3.1.20, 4.4.1.20).

Example: Pressure transmitter 5 to 10 bar absolute with 4 - 20 mA output signal.

$\rightarrow$ 4 mA <=> 0% <=> 5 bar absolute.

Data range:

0 bara ≤ Entry value ≤ 100 bara
0 PSIA ≤ Entry value ≤ 1450.4 PSIA

Error Number	Cause
47	Entry outside of data range

Example:

Pressure 0% for instrument number 01 is programmed at 0

Host	SOHP01PO0CRLF
Converter	SOHPO0CRLF

4.4.1.46 P1 Pressure 100%

Program the value of the 100% absolute pressure at the pressure input. The units are those selected in the pressure units menu (see 4.3.1.20 and 4.4.1.20).

Example: Pressure transmitter 5 to 10 bar absolute with 4 - 20 mA output signal.

→ 20 mA <=> 100% <=> 10 bar absolute.

Data range:

0 bara ≤ Entry value ≤ 100 bara
0 PSIA ≤ Entry value ≤ 1450.4 PSIA

Error Number	Cause
48	Entry outside of data range

Example:

Pressure 100% for instrument number 01 is programmed at 0

Host	SOHP01P10CRLF
Converter	SOHP10CRLF

4.4.1.47 PI Pressure Input

Program the current range for the pressure input.

INDEX NUMBER	CURRENT OUTPUT
0	0 - 20 mA
1	4 - 20 mA
2	0 - 10 mA
3	2 - 10 mA

Error Number	Cause
46	Entry > 3

Example:

Pressure Input for instrument number 01 is programmed at 1

Host	SOHP01PI1CRLF
Converter	SOHPI1CRLF

4.4.1.48 PK Constant Pressure

When measure pressure is turned off a constant pressure value can be programmed in the converter in this parameter. The units are the same as those selected in the pressure units menu (see 4.3.1.20, 4.4.1.20). This is only available when:

- the pressure measurement is turned off
- saturated steam has not been selected in the Fluid Menu 3.15

Data range:

0 bara ≤ Entry value ≤ 100 bara
0 PSIA ≤ Entry value ≤ 1450.4 PSIA

Error Number	Cause
52	Entry outside of data range

Example:

Constant Pressure for instrument number 01 is programmed at 0

Host	SOHP01PK0CRLF
Converter	SOHPK0CRLF

4.4.1.49 PM Measure Pressure

Program whether the measure pressure option is turned on or off. This is only available when saturated steam has not been selected in the fluid menu (3.15).

INDEX NUMBER	CONDITION
0	off
1	on

Error Number	Cause
51	Entry > 1

Example:

Measure Pressure for instrument number 01 is programmed at 0

Host	SOHP01PM0CRLF
Converter	SOHPM0CRLF

4.4.1.50 PN Adjust I_{in} 4 mA (For ABB use only.)

Program the value for 4 mA current input (= pressure input). The units are mA.

Data range: 2.0 ≤ Entry value ≤ 6.0

Error Number	Cause
69	Entry outside of data range

4.4.1.51 PS Adjust I_{in} 20 mA (For ABB use only.)

Program the value for 20 mA current input (= pressure input). The units are mA.

Data range: 10.0 ≤ Entry value ≤ 30.0

Error Number	Cause
70	Entry outside of data range

4.4.1.52 Pn Adjust I_{in} 4 mA (For ABB use only.)

When this function is called the converter automatically adjusts the current input of the 4 mA point (for pressure transmitter). An exact 4 mA current must be connected to the input contacts. The adjustment duration is approximately 15 seconds.

Data bytes: None

4.4.1.53 Ps Adjust I_{in} 20 mA (For ABB use only.)

When this function is called the converter automatically adjusts the current input of the 20 mA point (for pressure transmitter). An exact 20 mA current must be connected to the input contacts. The adjustment duration is approximately 15 seconds.

Data bytes: None

4.4.1.54 Q Q_{max} Mode

Program Qmax. This value corresponds to 100% flowrate in the operating mode selected. The units are a function of the operating mode selected. In the actual and standard modes Qmax has the volumetric units selected (see 4.4.1.13); in the mass mode Qmax has the gravimetric units selected (see 4.4.1.14).

Data range:

0 ≤ Entry value ≤ 1000000 l/s
or upper range limit converted to appropriate units, e.g. 1000 m^3/s

Error Number	Cause
47	Entry outside of data range

Example:

Q_{max} Mode for instrument number 01 is programmed at 1

Host	SOHP01Q>1CRLF
Converter	SOHQ>1CRLF

4.4.1.55 QM Q_{min} Actual

Program Qmin. This value corresponds to the low flow cutoff value. When the flowrate is less than Qmin the flowrate is set to 0. The units are function are the volumetric units selected (see 4.4.1.13).

Data range: 0 ≤ Entry value ≤ 10% of QmaxDN

Error Number	Cause
34	Entry outside of data range

Example:

Q_{min} Actual for instrument number 01 is programmed at 1

Host	SOHP01QM1CRLF
Converter	SOHQM1CRLF

4.4.1.56 SD Saturated Steam

Program whether the temperature or pressure value shall be used for the saturated steam measurements. Prerequisite that saturated steam is selected in the fluid menu (3.15).

INDEX NUMBER	MEASURED VALUE
0	Measure temperature
1	Measure pressure

Error Number	Cause
27	Entry > 1

Example:

Saturated Steam for instrument number 01 is programmed at 1

Host	SOHP01SD1CRLF
Converter	SOHSD1CRLF

4.4.1.57 SI Adjust I_{out} 20 mA (For ABB use only.)

Program the calibration value for the 20 mA output current. The units are mA.

Data range: 10 ≤ Entry value ≤ 30

Error Number	Cause
63	Entry outside of data range

4.4.1.58 SK Set Keypad Mode

Turn on the keypad mode, i.e. turn off the remote mode (see 4.7).

Data bytes: None

4.4.1.59 SP Language

Program the language.

INDEX NUMBER	LANGUAGE
0	German
1	English

Error Number	Cause
10	Entry > 1

Example:

Language for instrument number 01 is programmed at 1

Host	SOHP01SP1CRLF
Converter	SOHSP1CRLF

4.4.1.60 SR Set Remote Mode

Turn on the remote mode (see 4.7).

Data bytes: None

4.4.1.61 TK Constant Temperature

A constant temperature value can be programmed in the converter. The units are the same as those selected in the temperature units menu (see 4.3.1.19, 4.4.1.19). This is only available when:

- the temperature measurement is turned off
- saturated steam has not been selected in the fluid menu (3.15).

Data range: -150 ≤ Entry value ≤ 750 (for Celsius and Fahrenheit)

Error Number	Cause
50	Entry outside of data range

Example:

Constant Temperature for instrument number 01 is programmed at 1

Host	SOHP01TK1CRLF
Converter	SOHTK1CRLF

4.4.1.62 TM Measure Temperature

Program whether the measure temperature option is turned on or off. The is only available when saturated steam has not been selected in the fluid menu (3.15).

INDEX NUMBER	CONDITION
0	off
1	on

Error Number	Cause
49	Entry> 1

Example:

Measure Temperature for instrument number 01 is programmed at 1

Host	SOHP01TM1CRLF
Converter	SOHTM1CRLF

4.4.1.63 VA van der Waals Constant a

Program the value of the van der Waals constant a. The units are l^2 • atm/$mole^2$. Prerequisite is:

- gas has been selected in the fluid menu
- van der Waals has been selected in the gas calculation menu

Example:

van der Waals Constant a for instrument number 01 is programmed at 10.

Host	SOHP01VA10CRLF
Converter	SOHVA10CRLF

4.4.1.64 VB van der Waals Constant b

Program the value of the van der Waals constant b. The units are l/mole. Prerequisite is

- gas has been selected in the fluid menu
- van der Waals has been selected in the gas calculation menu

Example:

van der Waals Constant b for instrument number 01 is programmed at 10.

Host	SOHP01VB10CRLF
Converter	SOHVB10CRLF

4.4.1.65 VK Volume Expansion

Program the volumetric expansion coefficient for liquids. The units are percent/degree Celsius. Prerequisite is that liquid has been selected in the fluid menu.

Data range: 0.0 ≤ Entry value ≤ 10.0

Error Number	Cause
26	Entry outside of data range

Example:

Volume Expansion for instrument number 01 is programmed at 10.

Host	SOHP01VK10CRLF
Converter	SOHVK10CRLF

4.4.1.66 VT Gas Table for van der Waals

Program the gas selected for the van der Waals gas calculation. The a and b constants for the van der Waals are automatically selected for the programmed gas.

INDEX NUMBER	DESCRIPTION	SYMBOL
0	Oxygen	O_2
1	Nitrogen	N_2
2	Helium	He
3	Hydrogen	H_2
4	Argon	A
5	Neon	Ne
6	Chlorine	Cl_2
7	Carbon monoxide	CO
8	Carbon dioxide	CO_2
9	Sulfur dioxide	SO_2
10	Nitrous oxide	NO
11	Ammonia	NH_3
12	Hydrogen chloride	HC_l
13	Hydrogen sulfide	H_2S
14	Methane	CH_4
15	Acetylene	C_2H_2
16	Ethylene	C_2H_4
17	Ethane	C_2H_6
18	Propylene	C_3H_6
19	Propane	C_3H_8
20	Benzine	C_6H_6
21	Butane-n	C_6H_{10}

Error Number	Cause
22	Entry > 21

Example:

Gas Table for van der Waals for instrument number 01 is programmed at 0.

Host	SOHP01VT0CRLF
Converter	SOHVT00CRLF

4.4.1.67 Function Test

Before calling the test functions the converter must be switched to the function test mode. After conclusion of the function tests the function test mode must be turned off.

When the converter is in the function test mode, the output signals (current output, pulse output, alarm-, min. alarm-, and max. alarm-contacts) are no longer functional. They remain at the values which existed when the function test mode was turned on or the values to which they were set during the function test procedure. Only after the function test mode has been turned off will the outputs become functional, i.e. correspond to the flowrate.

The function test mode is turned on by:

- the ASCII command %1 (see 4.4.1.67.2)
- entering the function test submenu

The function test mode is turned off by:

- the ASCII command %0 (see 4.4.1.67.1)
- exiting the function test submenu

4.4.1.67.1 %0 Function Test Off

After completion of the test functions the function test mode must be turned off with this command.

Data bytes: None

4.4.1.67.2 %1 Function Test On

Before selecting a function test the converter function test mode must be turned on with this command.

Data bytes: None

4.4.1.67.3 %2 Function Test F_{out}

Set the pulse output in percent.

Data range: $0.0 \leq$ Entry value ≤ 115.0

Error Number	Cause
67	Entry outside of data range

Example:

%2 Function Test F_{out} for instrument 01 is programmed at 115.

Host	SOHP01%2115CRLF

Converter SOHP%2115CRLF

4.4.1.67.4 %3 Function Test I_{out}

Set the current output in percent.

Data range: 0.0 ≤ Entry value ≤ 115.0

Error Number	Cause
68	Entry outside of data range

Example:

%3 Function Test I_{out} for instrument 01 is programmed at 115.

Host SOHP01%3115CRLF

Converter SOHP%3115CRLF

4.4.1.67.5 %7 Function Test Alarm

Set the alarm output condition.

INDEX NUMBER	CONDITION
0	alarm off
1	alarm on

Example:

%7 Function Test Alarm for instrument 01 is programmed at 1.

Host SOHP01%71CRLF

Converter SOHP%71CRLF

4.4.1.67.6 %G Function Test Maximum Alarm

Set the maximum alarm output condition.

INDEX NUMBER	CONDITION
0	maximum alarm off
1	maximum alarm on

Example:

%G Function Test Maximum Alarm for instrument 01 is programmed at 1.

Host	SOHP01%G1CRLF
Converter	SOHP%G1CRLF

4.4.1.67.7 %H Function Test Minimum Alarm

Set the minimum alarm output condition.

INDEX NUMBER	CONDITION
0	minimum alarm off
1	minimum alarm on

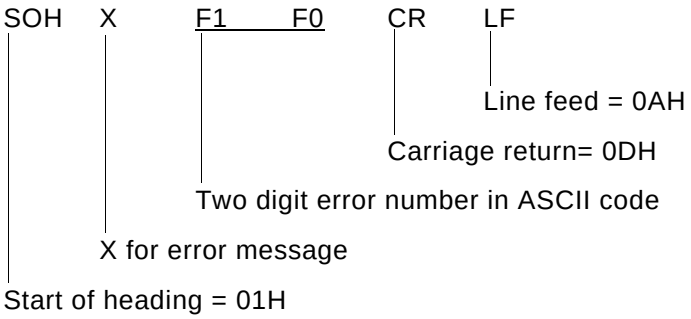
Example:

%H Function Test Minmum Alarm for instrument 01 is programmed at 1.

Host	SOHP01%H1CRLF
Converter	SOHP%H1CRLF

4.5 Error Codes

Transmitted data is tested by the converter for conformity to the communication protocol as well as for plausibility. If an error is encountered the converter transmits the following message to the communicating device.



4.5.1 Protocol and Communication Errors

ERROR NUMBER	CAUSE
01	Incorrect mode (M for monitor mode or P for programming mode)
02	Incorrect character code
04	Number of data bytes exceeded or invalid data bytes
05	Parity error
06	Access for character code not available

4.6 Remote Indication

A terminal can be used in conjunction with the serial data link to provide a remote indication. All information which appears on the display can also be transmitted to a remote location when in the remote mode. The converter can also be programmed from such a location.

A transmission speed between 1200 and 9600 baud is recommended.

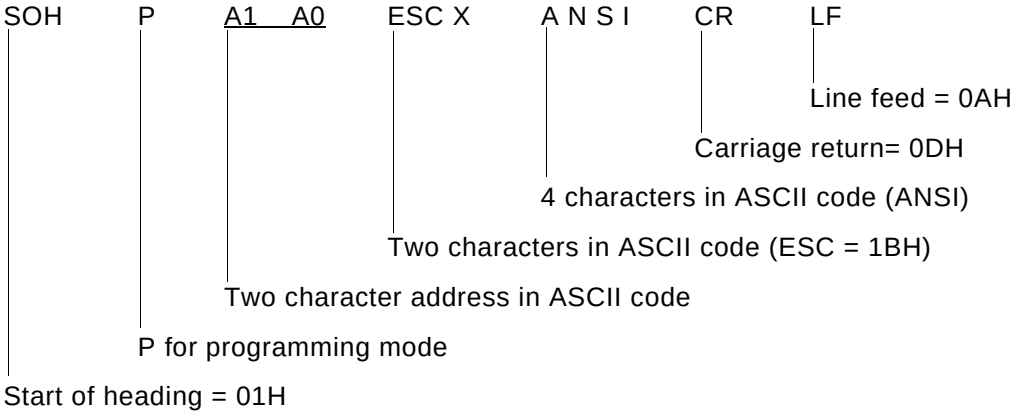
Two terminal types can be used for the remote indication.

a) ANSI terminal

b) Data terminal

4.6.1 ANSI Terminal

Communication with an ANSI terminal is made using the following protocol:



The communication is terminated by:

ESC O S (PF4)

ESC sequences are also used by the converter for data output:

ESC Sequence Operation:

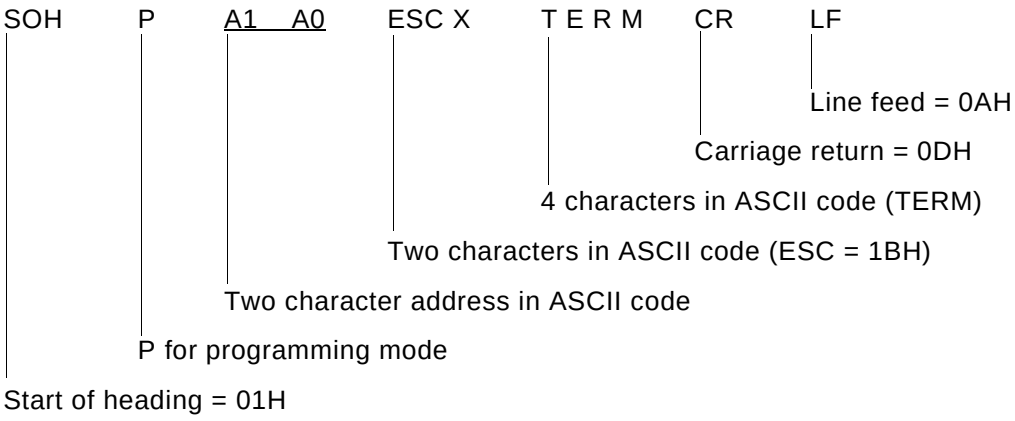
ESC [C	Cursor right
ESC [D	Cursor left
ESC [H	Cursor home
ESC [2 ; 1 H	Cursor to start of second line
ESC [2 J ESC [H	Clear screen and cursor home

The following terminal keys are used:

KEY	ASCII CODE	HEX CODE
0	0	30
1	1	31
2	2	32
3	3	33
4	4	34
5	5	35
6	6	36
7	7	37
8	8	38
9	9	39
Dot	•	2E
Minus	–	2D
Return	CR	0D
Del	DEL	7F
Cursor up	ESC [A	1B5B41
Cursor down	ESC [B	1B5B42

4.6.2 Data Terminal

Communication with a data terminal is made using the following protocol:



The communication is terminated by:

ESC O S

Control characters are also used by the converter for data output:

CONTROL SEQUENCE		OPERATION
ASCII	HEX	
HT	09	Cursor right
BS	08	Cursor left
VT CR	OB OD	Cursor home
CR LF	OD OA	Cursor to start of next line

The following terminal keys are used:

KEY	ASCII CODE	HEX CODE
0	0	30
1	1	31
2	2	32
3	3	33
4	4	34
5	5	35
6	6	36
7	7	37
8	8	38
9	9	39
Dot	•	2E
Minus	–	2D
Return	CR	0D
Del	DEL	7F
Cursor up	VT	0B
Cursor down	LF	0A

4.7 Remote Mode

The converter cannot be operated from the keypad when this mode is selected. The following message is displayed:

* REMOTE-MODE*

The only method to access or program parameters or data is by using the ASCII protocol.

The remote mode is turned on by the ASCII command SR (set Remote Mode, see 4.4.1.60).

The status register can be used to determine whether the remote mode is turned on or off (see 4.4.1.60).

The remote mode is turned off by the ASCII command SK (set Keypad Mode, see 4.4.1.58).

While the remote mode is selected the converter can be operated using the ASCII protocol in the usual manner; in the monitor mode (see 4.3), the programming mode (see 4.4) or the remote mode (see 4.6).

4.8 Data Link Modules

The converter hardware is available with various data link modules:

a) RS232 (V24)

b) RS485

The RS485 data link is bus compatible, i.e. a number of instruments can be connected and operated simultaneously.

4.8.1 Technical Data RS232C

Communication Mode: single-ended
Maximum number of drivers: 1
Maximum number of receivers: 1
Maximum cable length: 50 feet (15 m)
Maximum data rate: 20 kBaud
Signal without load: ±15 V
Signal with load: ±5 V

Refer to Figures 4-1 and 4-2.

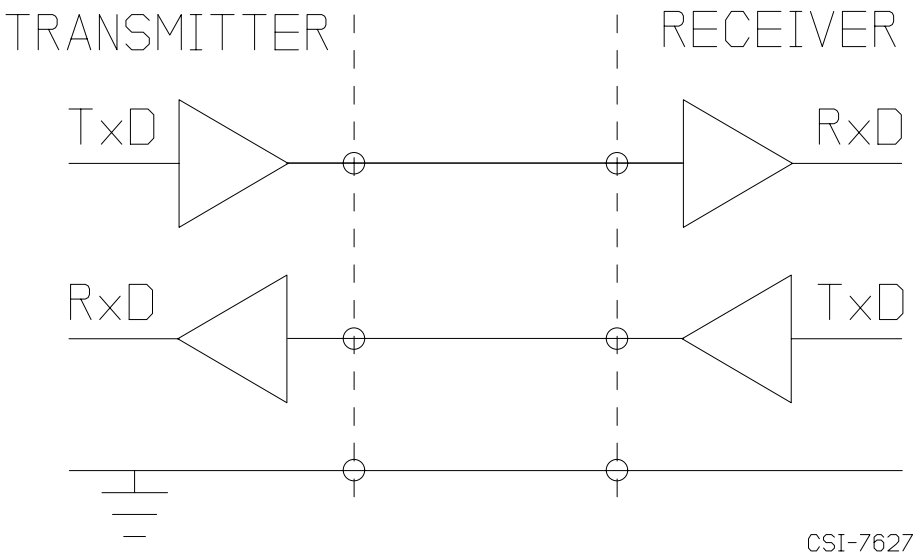


FIGURE 4-1. RS232C COMMUNICATION

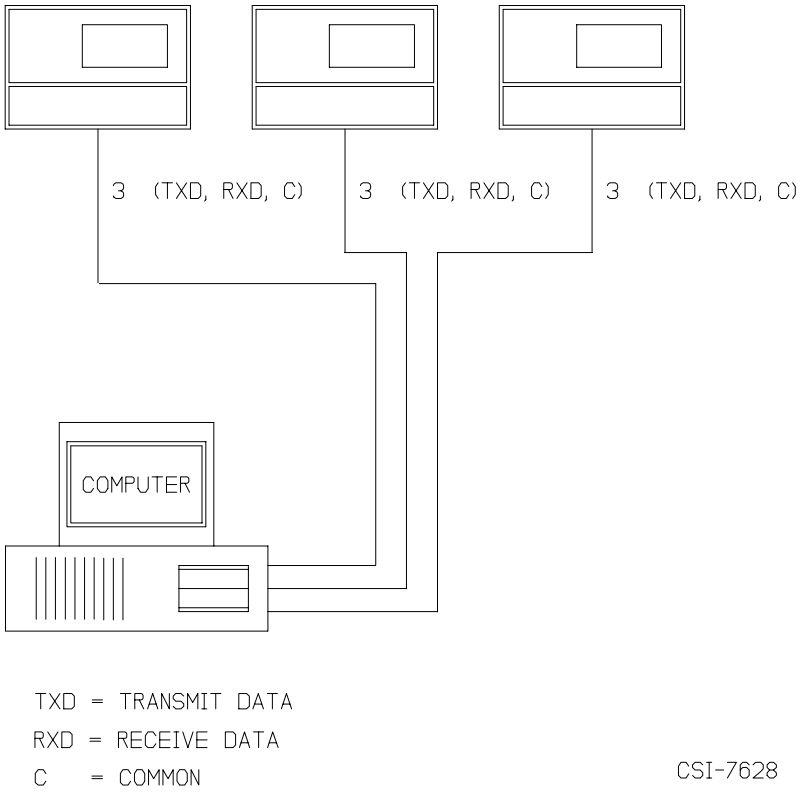


FIGURE 4-2. RS232C INSTALLATION

4.8.2 Technical Data RS485

Communication Mode: differential
Maximum number of drivers: 32
Maximum number of receivers: 32
Maximum cable length: 3940 feet (1200 m)
Maximums data rate: 10 MBaud
Signal without load: ±5 V
Signal with load: ±1.5 V

Refer to Figures 4-3 and 4-4.

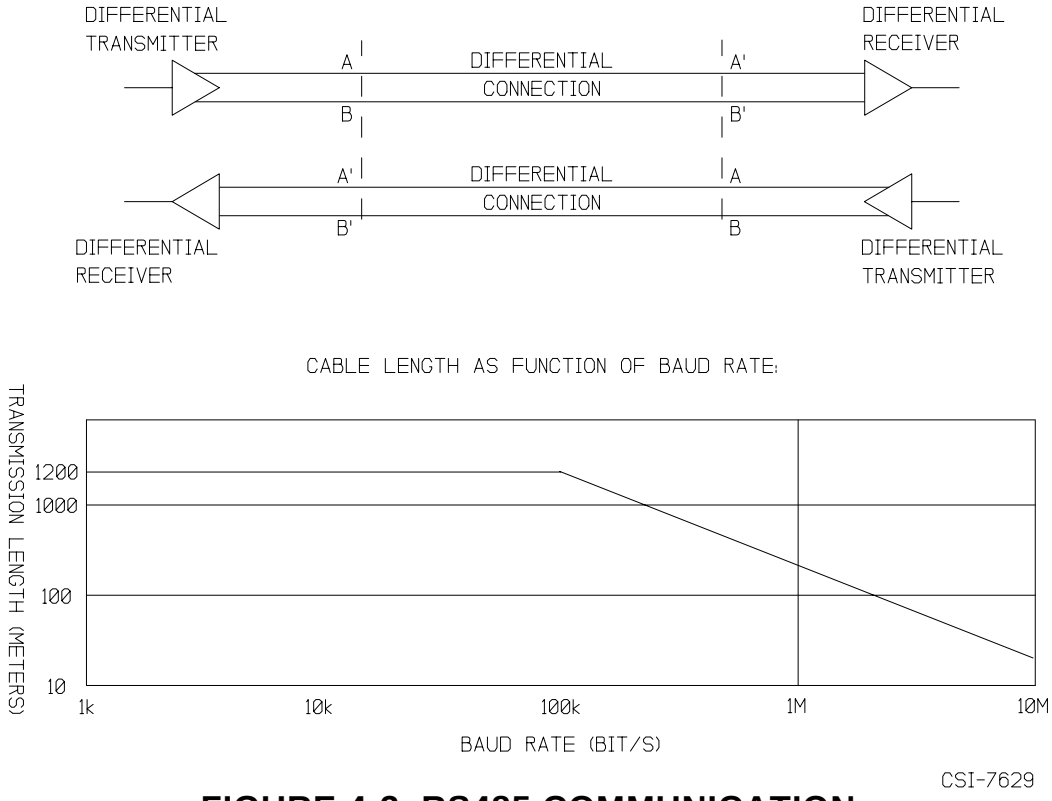


FIGURE 4-3. RS485 COMMUNICATION

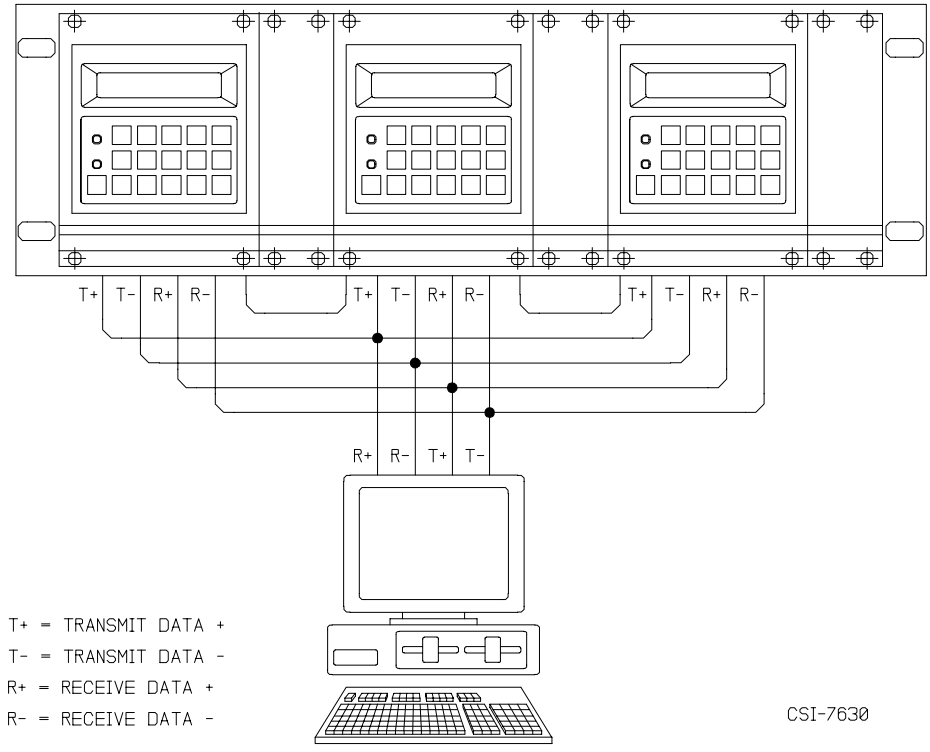


FIGURE 4-4. RS485 INSTALLATION

5.0 TROUBLESHOOTING

Problem	Corrective Action
A. No indication or backlight on display when power is applied.	1. Check ac power connections to flow computer terminal block. 2. Check for 120 V ac at terminal block. 3. Check flow computer fuses: F101 on analog board and F901 on connection board.
B. No flow indication when flow exists through meter.	1. Verify that hook switches S1 through S21 (located in the flow meter housing) are set correctly for the meter size and fluid. 2. Verify that all menu parameters are entered correctly. 3. Using the Display Sub-menu Parameter, configure one line of the display to indicate "Frequency". a) If sensor frequency is displayed, meter is defective and must be returned to ABB Inc.for repair. b) If no sensor frequency is displayed: (1) Check cable wiring between preamplifier electronics and flow computer e.g., that color coded wires at the preamplifier are connected to their corresponding terminal numbers at the flow computer's terminal block. (2) Check that the sensor leads are properly secured to the preamplifier board connector 19 and 2B. (3) If sensor leads are properly secured, remove sensor leads from preamplifier terminal block and (if available) connect sine-wave generator leads to terminal block. Using an oscilloscope, set sine-wave generator output voltage to approximately 100 mV P-P and signal frequency to 40 Hz for liquid meters and 300 Hz for gas meters. If display shows sine-wave generator frequency and flow indication, sensor is defective and must be replaced.
C. Error code 2 (preamplifier)	1. Check for 30 V dc between pins 12 and 3 at flow computer and preamplifier terminal block. 2. Check cable wiring between preamplifier electronics and flow computer e.g., that color coded wires at the preamplifier are connected to their corresponding terminal numbers at the flow computer's terminal block.
D. Error code 7 (pressure)	1. Check that cable wiring between pressure transducer and flow computer are properly connected and secure. 2. Check for 30 V dc between terminals P+ and 3 at flow computer's terminal block.
E. Error code 8 (temperature)	1. Check that cable wiring between temperature transducer and flow computer are properly connected and secure. 2. If a four wire connection is being used, check for dc voltage between the flow computer's terminals UT+ and UT-.

CUT ALONG LINE, FOLD, STAPLE

DOCUMENTATION QUESTIONNAIRE

Your answers to the questions below and other comments assist us in publishing better documentation. If an answer requires explanation please use the space provided. All comments and suggestions become the property of ABB Inc.

1. Title of Document? **INSTRUCTION BULLETIN 50VM1000 PN24619**

2. Does this document meet your needs?_____

3. Is the information:

   Easily understandable?_____

   _____

   _____

   Properly organized? _____

   _____

   Complete? _____

   _____

   _____

   Sufficiently illustrated? _____

   _____

   _____

OTHER COMMENTS

(Please include page and/or figure number.)

_____

_____

_____

_____

_____

Name _____

Address _____

_____

_____

No postage necessary
if mailed in the U.S.A.

If ABB employee, please include
department number.

FORM NO. 265-304

FOLD 1

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 86 WARMINSTER, PA

POSTAGE WILL BE PAID BY ADDRESSEE:

ABB INC.
DEPARTMENT 261 / A2
125 E. COUNTY LINE ROAD
WARMINSTER, PA 18974

Attention: Technical Publications

FOLD 2

STAPLE HERE

PN24619

ABB Inc.
125 East County Line Road
Warminster, PA 18974 USA
Tel. 215-674-6000
FAX: 215-674-7183

ABB Instrumentation Ltd
Howard Road, St. Neots
Cambs. England, PE19 3EU
Tel. +44 (0) 1480-475-321
FAX: +44 (0) 1480-217-948

ABB Instrumentation S.p.A
Via Sempione 243
20016 Pero (Milano) Italy
Tel: +39 (02) 33928 1
Fax: +39 (02) 33928 240

ABB Automation Products GmbH
Industriestr. 28
D-65760 Eschborn Germany
Tel: +49 (0) 6196 800 0
Fax: +49 (0) 6196 800 1849