MAG-SM

Converter 50SM1000 Field Mount Housing and 19“-Design

Instruction Bulletin

D184B085U02 Rev. 01 / 06.2001

CE

Software Revisions C.4X/X.3X & higher
Standard-Design EPROM
Part-No. D699B154U01

HART-Design EPROM
Part-No. D699B164U01

For Flowmeter Primaries with
AC Magnetic Field Excitation
Models: DS21_, DS4_, 10DS2111, 10DS2112, 10DS3111, 10DS3112, 10DS3121, 10DI1425, 10D1422

ABB

You have purchased a high quality, modern
Electromagnetic Flowmeter system from ABB Automation Products.
We appreciate your purchase and the confidence you have expressed in us.

This Instruction Bulletin contains information relating to the
assembly and installation of the instrument and its specifications.
ABB Automation Products reserves the right to make hardware and software
improvements without prior notice. Any questions which may arise
that are not specifically answered by these instructions should be
referred to our main plant in Göttingen, Germany Tel 49-551/905-0
or to our Technical Service Department.

The interference resistance of this converter complies with the
NAMUR-Recommendations „EMC-Guidelines for Manufacturers
and Operators of Electrical Instruments and Systems"
Part 1, 5/93 and EMC-Guideline 89/336/EWG

(EN 50081-1, EN 50081-2)
(EN 50082-1, EN 50082-2)

Introductory Safety Notes for the EMF System

Regulated Usage
The Electromagnetic Flowmeter System (EMF), consisting of a flowmeter primary and a converter, is manufactured in state of the art designs and is safe to operate. The flowmeter is to be installed exclusively in applications which are in accord with the specifications.

Every usage which exceeds the specifications is considered to be non-specified. Any damages resulting therefrom are not the responsibility of the manufacturer.
The user assumes all risk for such usage.

The applicable specifications include the installation, start-up and service requirements specified by the manufacturer.

Installation, Start-Up and Service Personnel

Please read this Instruction Bulletin and the safety notes before attempting installation, start-up or service.

Only qualified personnel should have access to the instrument. The personnel should be familiar with the warnings and operating requirements contained in this Instruction Bulletin.

Assure that the interconnections are in accordance with the Interconnection Diagrams.
Ground the flowmeter system.

WHen the housing cover is removed, the EMC-Protection is reduced.

Observe the warning notes designated in this document by the symbol:

Hazardous Material Information

In view of the Disposal Law of 27 Aug. 86 (AbfG. 11 Special Wastes) the owner of special wastes is responsible for its care and the employer also has, according to the Hazardous Material Law of 01 Oct. 86 (GefStoffV, 17 General Protection Responsibility), a responsibility to protect his employees, we must make note that

a) all flowmeter primaries and/or flowmeter converters which are returned to ABB Automation Products for repair are to be free of any hazardous materials (acids, bases, solvents, etc.).

b) the flowmeter primaries must be flushed so that the hazardous materials are neutralized. There are cavities in the primaries between the metering tube and the housing. Therefore after metering hazardous materials, these cavities are to be neutralized (see Hazardous Material Law -GefStoffV). For two piece housings the housing screws are to be loosened. For flowmeter primaries ≥ 14"/DN 350 the drain plug at the bottom of the housing is to be removed in order to neutralize any hazardous material in the magnet coil and electrode areas.

c) for service and repairs **written confirmation** is required that the measures listed in a) and b) have been carried out.

d) any costs incurred to remove the hazardous materials during a repair will be billed to the owner of the equipment.

EG-Konformitätserklärung
EC-Certificate of Compliance

CE

Hiermit bestätigen wir die Übereinstimmung der aufgeführten Geräte mit den Richtlinien des Rates der Europäischen Gemeinschaft. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.

Herewith we confirm that the listed instruments are in compliance with the council directives of the European Community. The safety and installation requirements of the product documentation must be observed.

Modell: *Model:*	50SM1000 10DS21.. 10DS31.. DS21.. DS41..
Richtlinie: *Directive:*	EMV Richtlinie 89/336/EWG * EMC directive 89/336/EEC *
Europäische Norm: *European Standard:*	EN 50081-1, 3/93 * EN 50082-2, 2/96 *
Richtlinie: *Directive:*	Niederspannungsrichtlinie 73/23/EWG * Low voltage directive 73/23/EEC *
Europäische Norm: *European Standard:*	EN 61010-1, 3/94 *

* einschließlich Nachträge
including alterations

Göttingen, 10.05.2000

.....
Unterschrift / Signature

BZ-13-5101, Rev.2, 1699

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Electromagnetic Flowmeter Converter

1. Functional Description

The converter processes the flowrate proportional signals from the electromagnetic flowmeter primary into frequency proportional pulse signals (scaled or unscaled output) and into a current output (See “Block Diagram” on page37)..

> **Note:**
> It is important to assure that only a flowmeter primary designed for AC magnetic field excitation is connected to the converter Model 50SM1000.
>
> Flowmeter Primary Model Numbers:
> DS21...., DS41...., DS41....>12”(DN300), 10DS2110,10DS3110, 10DS3111 E >12”(DN300), 10DS3112, 10DS3121, 10DI1425 <20”(DN500), 10DI1425 >16”(DN400”, 10D1422

2. Assembly and Installation

2.1 Inspecting the Converter

Before installation check the converter for damage due to possible mishandling during shipping. All claims for damage are to be made promptly to the shipper before installation.

2.2 Converter Installation

The installation site for the converter must be essentially free of vibration. The specified temperature limits of -20 °C and +60 °C must be observed. Consideration must be given to assure that the max. cable length specifications between the converter and the flowmeter primary are not exceed; 50 m for the standard design and 200 m for designs which include a preamplifier.

In addition, the installation site of the converter should not be exposed to direct sunlight. If the ambient temperature limit of +60 °C is exceeded the readability of the LC-Display is affected. It will no longer be possible to read the process information. If it in not possible to avoid direct sunlight, a sun shield should be installed.

Field Mount Housing

The converter housing is designed for Protection Class IP 65 (EN 60529). The lower housing section is to be mounted using 4 screws, see “Dimension Drawings” on Page 2.

19”-Converter Insert

The insert cassette, 167 mm long, is designed for Protection Class IP 00. The inserts are mounted in a 19“-Card Frame. Up to four converters can be mounted in one 19“-Card Frame. The 19“-Card Frames per DIN 41494 will fit in any 19“-Cabinet or Rack, see “Dimension Drawings” on Page 2.

> **Note:**
> When the contact in- and output for a 19”-Converter are configured as optocouplers (available as an option) the control card (7TE) is not required. In this arrangement up to four converters can be installed in a single 19”-Card Frame.

19”-Stainless Steel Protective Housing

When mounting the 19”-stainless steel protective housing - see “Dimension Drawings” on Page 2 - in 3 HE or 6 HE and larger, a heavy duty anchor (Hilti HSA-Anchor) is recommended for mounting to a wall.

Rear Panel Mount Housing for 19”-Converter

After the panel cutout has been competed - see ‘Dimension Drawings” on Page 2 - insert the panel mount housing and tighten the 4 holding brackets against the front plate. The mounting of the panel mount housing is complete.

Interchangeability of Converters

Although the functions of the converter inserts are the identical for all flowmeter sizes, it is important to check that the supply power specifications and the output functions are the same for both converters before any replacement is made. After the converters are exchanged the meter location parameters can be uploaded into the replacement converter by calling the parameter „Load data from ext. EEPROM“ with ENTER. See also Page 26.

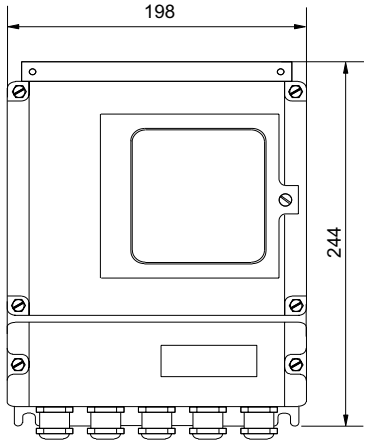
Instruction Bulletin

Flowmeter Primary	Converter
MAG-SM D184B064U01 Rev. 02	50SM1000 D184B085U01 Rev. 01

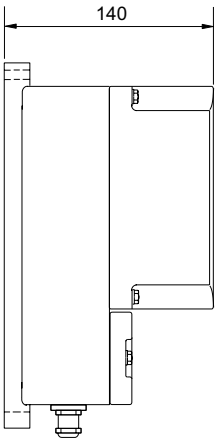
Specification Sheet
MAG-SM D184S034U01 Rev. 01

Flowmeter Primary Simulator
55XC4000 D184B049U01

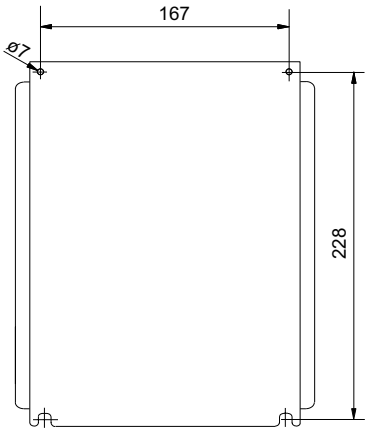
2.3 Dimension Drawings



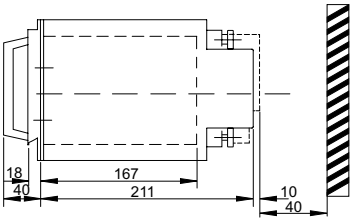
Field Mount Housing



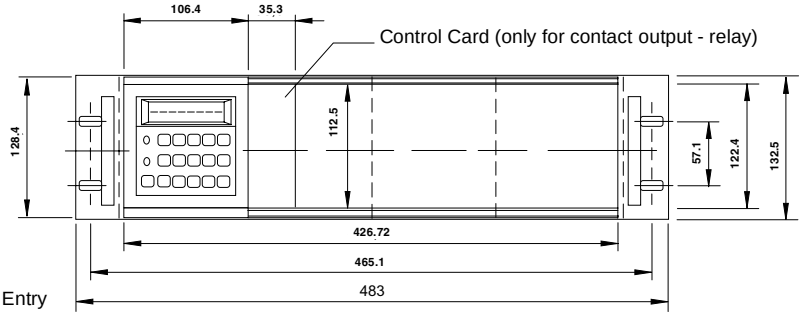
Cable Connector M20 x 1.5



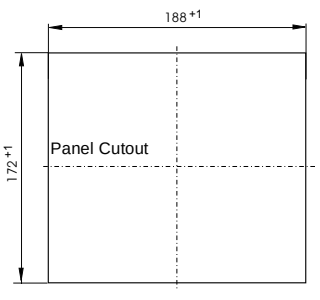
Mounting Dimensions

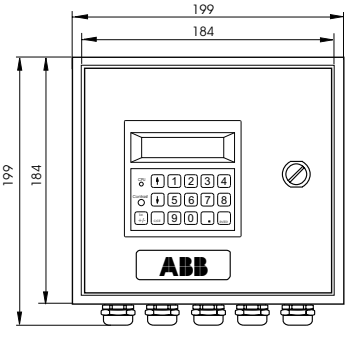


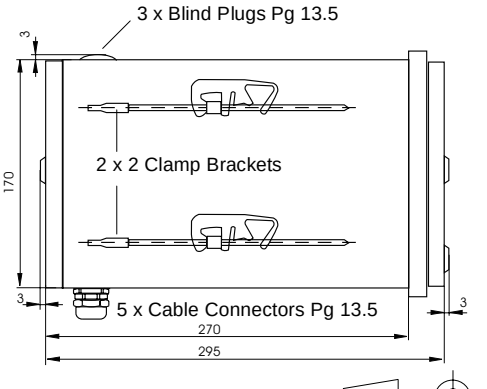
Min. Distance for Cable Entry



19”-Insert with Card Frame







Rear Panel Mount Housing (Stainless Steel)

All Dim’s in mm

Projektion nach ISO Methode E

Fig.1 Dimension Drawings

2.4 Electrical Interconnections, Converter

2.4.1 Supply Power Connections

The supply power, which should conform to the specifications listed on the instrument tag, is connected to terminals L (Phase) and N (Neutral) or 1L1 and 1L2 over a mains fuse and a mains switch. The cable cross section of the supply power connections and the installed fuse size must be compatible (VDE 0100). The housing is grounded by connecting the terminal ⏚ |round.

> **! Warning:**
> Observe the supply power limits (values listed in the Specification Sheet). The voltage drop in the supply power leads for the 24/48 V AC design must be considered when long cables with small cross sections are installed.

The connections are to be made in accordance with the Interconnection Diagrams beginning on Page 7.

2.4.2 Magnet Coil Supply

The magnet coil supply varies as a function of the flowmeter size! The appropriate Interconnection Diagrams are to be used!

Flowmeter Primaries 1/10" to 16" [DN 3 to DN 400]:

The magnet coils are supplied directly from the converter over terminals M1, M3 with a shielded cable, e.g. 2x1.5 mm^2.

Excitation voltage approx. 60 V AC, 50/60 Hz.

Flowmeter Primaries 20" to 40" [DN 500 to DN 1000]:

The magnet coils are supplied from a line supply and not from the converter. Assure that the flowmeter primary and the converter are both supplied over a **single** mains switch and a **single** mains fuse.

Supply power 115/230 V AC, 50/60 Hz.

Flowmeter Primaries 10DS3112 in Ex-Design:

The magnet coiuls are supplied directly from the converter over terminals F1, F3 with a shielded cable, e.g. 2x1.5 mm^2.

Excitation voltage approx. 12 V AC, 50/60 Hz.

Flowmeter Primaries 10DS3111, 10DS3121 in Ex-Design:

The magnet coils are supplied directly from the converter over terminals M1, M3 with a shielded cable, e.g. 2x1.5 mm^2.

Excitation voltage approx. 48 V AC, 50/60 Hz.

! Check converter Model Number, the correct coordination with the Ex-Flowmeter Primary type must be assured . (See converter and flowmeter primary Instrument Tags).

> **! Warning:**
> The signal in- and output circuits may only be connected to circuits which are not hazardous to personnel contact (EN 61010-1).

2.4.3 Power

The connection voltage and the current for the flowmeter primary are listed on the Instrument Tag. The cable cross-section for the supply power and the fuse size must be compatible (VDE 0100).

Flowmeter Size	Power
	for Models 10D1422, 10DI1425, 10DS3111A, B, C
≤ 16" DN 400	≤ 30 W
20" DN 500	315 W
24" DN 600	405 W
28" DN 700	655 W
32" DN 800	745 W
36" DN 900	910 W
40" DN 1000	1200 W
20" – 40" DN 500 – 1000	for Models 10DS3111D ≤ 30 W
1/25" - 40" DN 1 – 1000	for Models DS21_, DS4_ ≤ 30 W

2.4.4 Signal and Reference Voltage Cable Connections

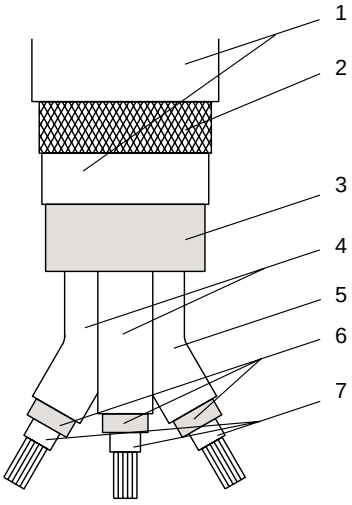
> **Warning:**
> The signal cable connections are a function of the flowmeter primary size! The appropriate Interconnection Diagram is to be used!

The signal cable should be routed using the shortest path because the ac signal voltage in the cable is only a few millivolts. The cable should not be routed in close proximity to large electrical machinery and switch gear equipment which could induce stray fields, pulses and voltages.The signal cable should not be fed through junction boxes or terminal strips.

The maximum allowable signal cable length for the flowmeter primary designs without a preamplifier is 50 m. If a preamplifier is installed in the flowmeter primary for metering low conductivity fluids, the maximum signal cable length is 200 m.

A shielded reference voltage lead is located in the cable parallel to the signal leads. The signal cable construction includes a copper shield which encloses the individually shielded signal leads and the shielded reference leads. The outer shield is connected to the terminal ⏚ in the converter housing. The shields of the signal leads act as “Driven Shields” for the signal transmission. The signal-/reference voltage cable is connected in accordance with the Inerconnection Diagrams to the flowmeter primary and the converter.

The supply voltage for the MAG-SM with a preamplifier is connected to terminals -U and +U, instead of 1S and 2S. If the actual flow direction does not agree with the direction indicated by the arrow on the flowmeter primary, the connections to terminals 1 and 1S must be interchanged with those to 2 and 2S. For flowmeter primaries with preamplifiers only the connections to terminals 1 and 2 must be interchanged to reverse the direction indicators.



1	PVC jacket, white	5	Reference voltage jacket, white
2	Woven steel wire shield, ∅0.15 mm	6	1 each shielded, woven copper wires, ∅0.1 mm
2	Woven copper wire shield, 0.13 mm	7	Polyethylene, natural
4	Electrode flow signal ∅0.75 mm		

Fig.2 Signal Cable Construction D173D018U02

> **Note:**
> The flowmeter system complies with the NAMUR-Recommendations 5/93 “Electromagnetic Compatibility of Equipment in Process and Laboratory Applications”. A new signal cable was developed and introduced to meet these requirements which utilizes two separate outer shields. The outer shield is connected to terminal SE in the flowmeter primary and to terminal ⏚ in the converter.
>
> If the flowmeter primary does not include a SE terminal then only one end of the outer shield is to be connected at the converter.

2.4.5 Cable Connection Area

The leads of the signal cable are to be routed in the shortest manner to the connection terminals. Loops are to be avoided, (see Figs. 4 and 5).

Cable Connection Area with Screwless Spring Loaded Terminals

Procedure: Press the spring element (1) and insert the stripped lead (2).
Release the pressure (3) on the spring element (Fig. 3).

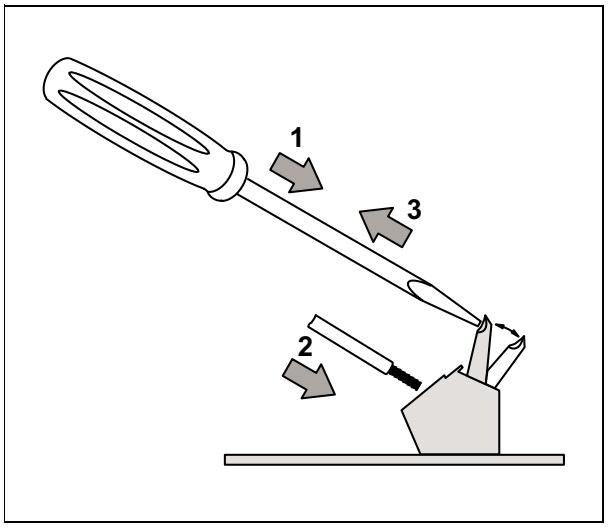
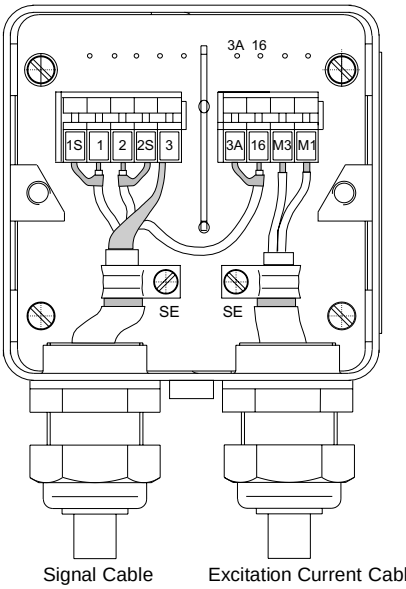
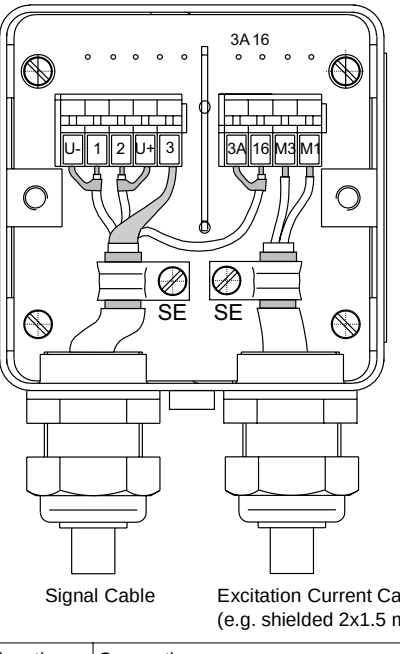


Fig.3 Cable Insertion with Screwless Spring Loaded Terminals

Care should be exercised when reinstalling and tightening the housing box cover. Check that the gasket is properly seated. Only then is Protection Class IP **67** assured.



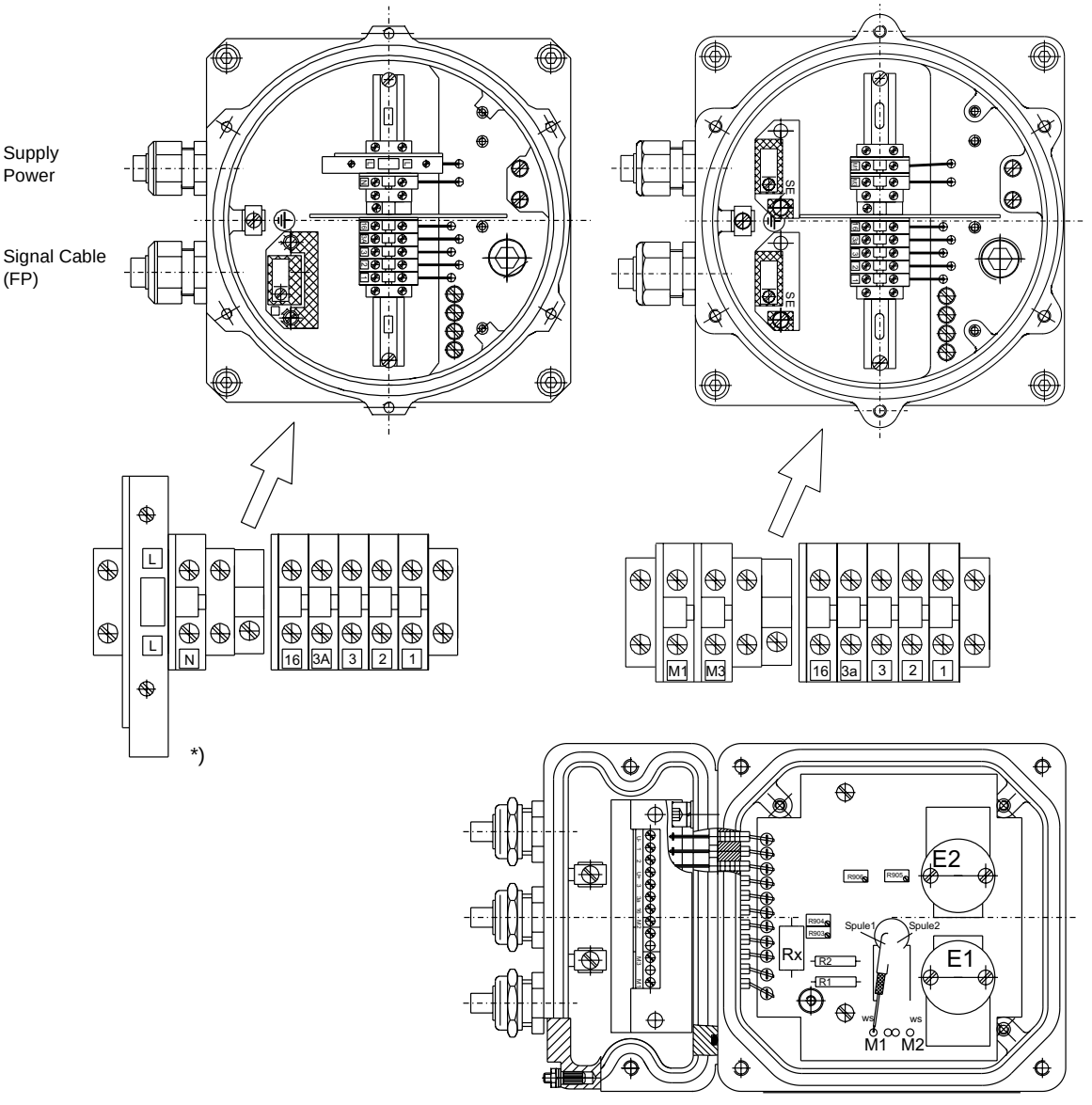


Terminal Designations	Connections
1 + 2	Flow signal leads (red and blue)
1S + 2S	Flow signal lead shields
U+/U-	Preamplifier supply voltage over signal lead shields
16	Reference voltage lead (white)
3a	Reference voltage lead shield
3	Inner cable shield (copper) common potential
SE	Outer shield (steel)
M1 + M3	Magnetic field excitation connections (from converter)

Fig.4 Connection Area for Flowmeter Primary ≤ **12" (DN 300)**

≥ 20” (DN 500)

14” – 16” (DN 350 – DN 400) Standard Design



Connection Box with Preamplifier
for Fluids with Low Conductivity ≥ 0.5 µS/cm

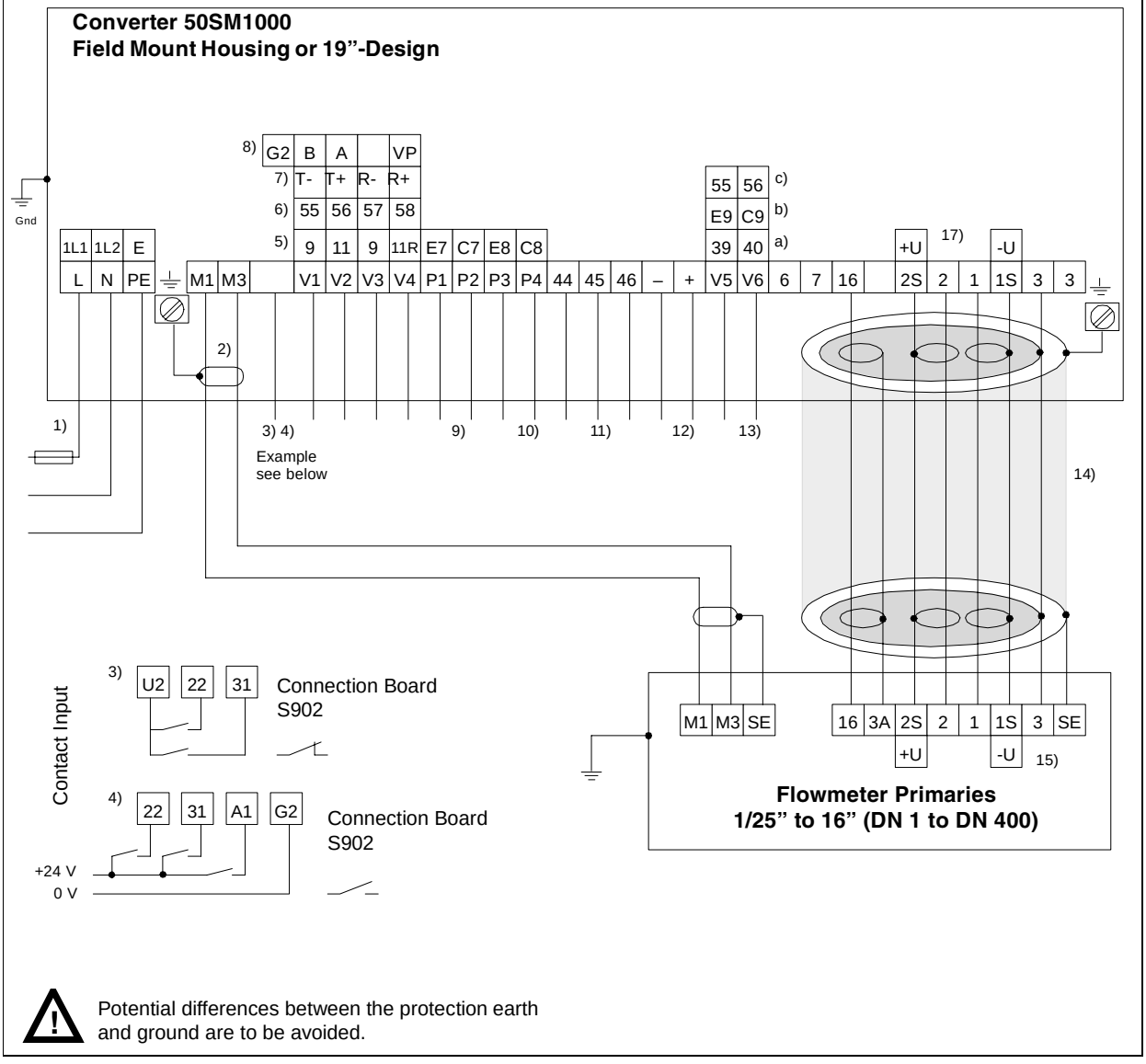
Terminal Designation	Connection
1 + 2	Flow signal leads
1S + 2S (U+/U-)	Flow signal lead shields ( ) Preamplifier supply voltage
16	Reference voltage lead
3A	Reference voltage lead shield
3	Inner cable shield (copper) common
*) M1 + M3	Magnetic field excitation connections (from converter)
*) L + N	For ≥20” (DN 500) Supply power see Instrument Tag

Fig.5 Connection Box Flowmeter Primary

2.5 Interconnection Diagrams

2.5.1 Interconnection Diagrams, Flowmeter Primaries 1/25” - 16” [DN 1 - DN 400] with Converter in Field Mount Housing or 19”-Design

Note:
Select the flowmeter primary model number in the parameter “Primary Type” in Submenu “Primary” in the converter. Switch S901 on the connection board of the converter must be opened (Connection Board, see Pages 38/39/40). If the flowmeter primary does not include a SE terminal then only one end of the outer shield is to be connected at the converter.



Potential differences between the protection earth and ground are to be avoided.

Fig.6 Interconnection Diagram Converter 50SM1000, Flowmeter Primaries 1/25”-16” (DN 1 - DN 400)

1) Supply power, see Instrument Tag.

2) Supply cable, e.g. shielded 2x1.5 mm^2. terminals M1/M3.

3) External zero return, passive, over contact with internal voltage supply terminals U2 (+24 V DC) and 22, switch S902 closed.

External totalizer reset, passive over contact with internal voltage supply terminals U2 (+24 V DC) and 31, switch S902 closed.

4) External totalizer reset with external voltage supply (for galv.isolation) terminals G2 (–) and 31 (+24 V DC). Switch S902 on the connection board must be opened.

External zero return with external voltage supply (for galv.isolation) terminals G2 (–) and 31 (+24 V DC). Switch S902 on the connection board must be opened.

Dynamic zero compensation with external voltage supply (for galv.isolation) terminals G2 (–) and A1 (+24 V DC). Switch S902 opened. The fluid must be at absolute zero flowrate the metering tube must be completely filled, see 3.3.

5) * Scaled pulse output, 24 V DC active, load ≥150 Ω , fmax 10 kHz
terminals V1, V2; Function 9, 11 forward
terminals V3, V4; Function 9, 11R reverse

6) * Scaled pulse output, passive, relay contact, ≤28 V DC, ≤250 mA, ≤3 W, fmax 20 Hz
terminals V1, V2; Function 55, 56 forward
terminals V3, V4; Function 57, 58 reverse

7) Option, data link RS 485. terminals V1, V2, V3, V4; Function T-, T+, R-, R+.

8) Option, data link Profibus DP, terminals V1, V2, V4, G2, Function RxD/TxD-P(B), RxD/TxD-N(A), +5V (VP), DGND(G2) terminals V4, G2 only to be used for bus termination.

9) Alarm max., relay contact ≤28 V DC, ≤250 mA, ≤3 W,
passive or optocoupler U_{CE} ≤25 F, I_{CE} ≤7.5 mA. terminals P1, P2; Function E7, C7.

10) Alarm min., relay contact ≤28 V DC, ≤250 mA, ≤3 W,
passive or optocoupler U_{CE} ≤25 F, I_{CE} ≤7.5 mA. terminals P3, P4; Function E8, C8.

11) Forward/reverse direction signal, relay contact ≤28 V DC, ≤250 mA, ≤3 W. terminals 44, 45, 46.

12) Current output, R_L ≤550 Ω 0/4–20 mA, 0–10–20 mA, 4–12–20 mA, R_L ≤1000 Ω 0/2–10 mA, R_L ≤2000 Ω 0–5 mA. terminals –, +.

13) a) Alarm output, relay contact opens at alarm, ≤28 V DC, ≤250 mA, ≤3 W, terminals V5, V6; Function 39, 40 or

b) Alarm output, optocoupler, U_{CE} ≤25 F, I_{CE} ≤7.5 mA. terminals V5, V6; Function E9, C9.

If a passive scaled pulse output is required in addition to the data link, then the alarm output is not available.

c) Scaled pulse output, passive, relay contact (closes) ≤28 V DC, ≤250 mA, ≤3 W
terminals V5, V6; Function 55, 56 forward.

14) Shielded signal cable (10 m included with shipment from ABB), ABB Part No. D173D018U02.

15) Supply voltage for flowmeter primaries with preamplifiers (1/25” - 5/16” [DN 1 - DN 8] always include a preamplifier), terminals +U, -U.

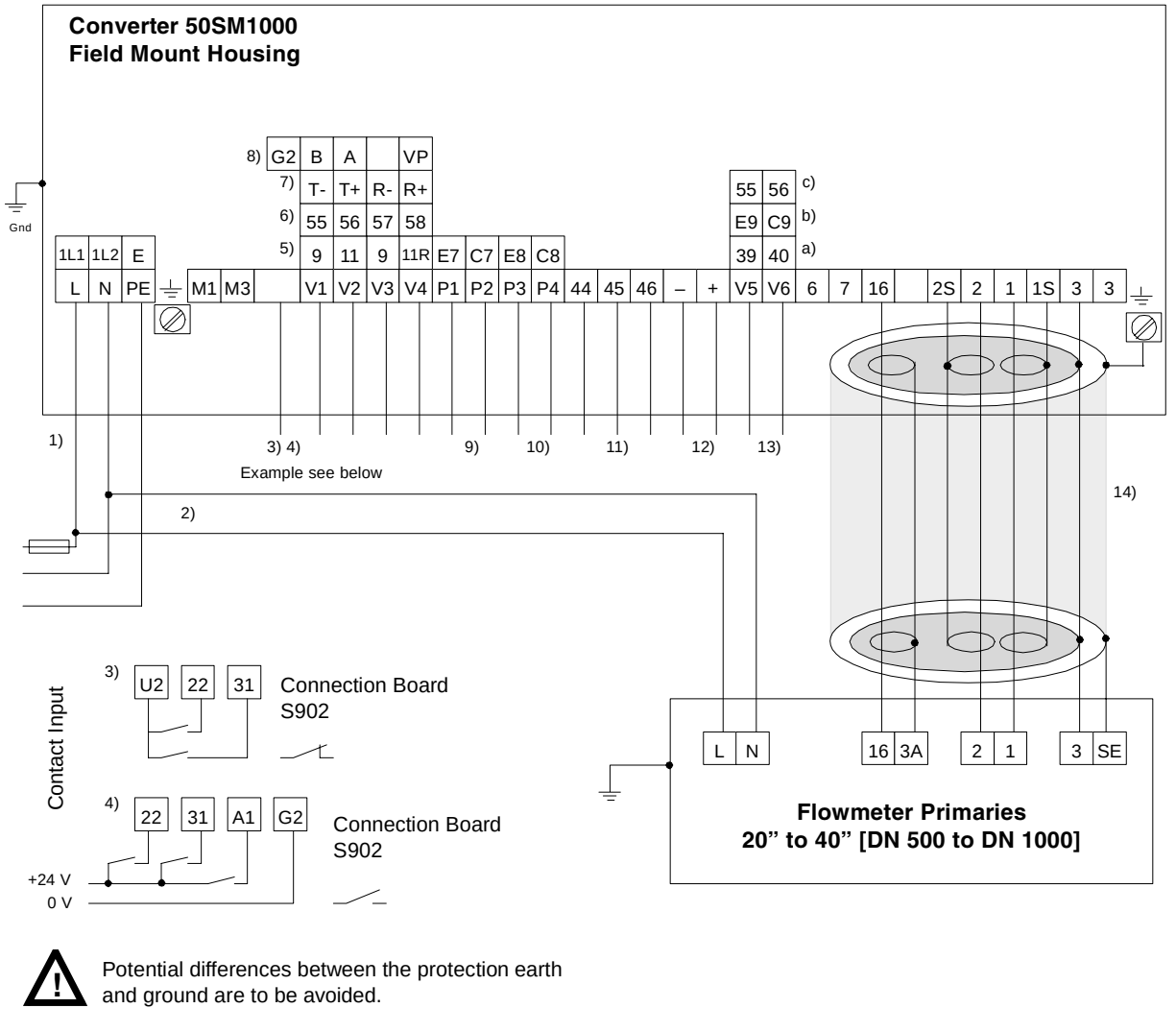
*) Scaled pulse output, active or passive, pulse width can be set from 0.032 to 2000 ms.

Terminal Designations 1/25” to 16” [DN 1 to DN 400]

2.5.2 Interconnection Diagram, Flowmeter Primaries 20" - 40"[DN 500 to DN 1000] With Converter in Field Mount Housing or 19"-Design (starting with 10DS3111D)

Note:
Select the flowmeter primary model number in the parameter "Primary Type" in the Submenu "Primary" in the converter. Switch S901 in the connection board of the converter must be opened (Connection Board, see Pages 38 – 40).

WARNING:
The magnet coils are supplied from the line, not from the converter. It is essential that both the flowmeter primary and the converter are connected over a **single** mains switch and a **single** mains fuse.



Potential differences between the protection earth and ground are to be avoided.

Fig.7 Interconnection Diagram for Flowmeter Primaries 20" to 40" [DN 500 to DN 1000]

1) Supply power, see Instrument Tag.

2) Magnet coil supply from line.

3) External zero return, passive, over contact with internal voltage supply, terminals U2 (+24 V DC) and 22. Switch S902 closed.

External totalizer reset, passive over contact with internal voltage supply, terminals U2 (+24 V DC) and 31. Switch S902 closed.

4) External totalizer reset, with external voltage supply (for galv. isolation) terminals G2 (–) and 31 (+24 V DC). Switch S902 on the connection board must be opened.

External zero return, with external voltage supply (for galv. isolation) terminals G2 (–) and 22 (+24 V DC). Switch S902 on the connection board must be opened.

Dynamic zero compensation with external voltage supply (for galv.isolation) terminals G2 (–) and A1 (+24 V DC). Switch S902 opened. The fluid must be at absolute zero flowrate the metering tube must be completely filled, see 3.3.

5) * Scaled pulse output, 24 V DC active, load ≥150 Ω , fmax 10 kHz
terminals V1, V2; Function 9, 11 forward
terminals V3, V4; Function 9, 11R reverse

6) * Scaled pulse output, passive, relay contact, ≤28 V DC, ≤250 mA, ≤3 W, fmax 20 Hz
terminals V1, V2; Function 55, 56 forward
terminals V3, V4; Function 57, 58 reverse

7) Option, data link RS 485. terminals V1, V2, V3, V4; Function T-, T+, R-, R+.

8) Option, data link Profibus DP terminals V1, V2, V4, G2, Function RxD/TxD-P(B), RxD/TxD-N(A), +5V (VP), DGND(G2) terminals V4, G2 use only for bus termination.

9) Alarm max., relay contact ≤28 V DC, ≤250 mA, ≤3 W,
passive or optocoupler U_{CE} ≤25 F, I_{CE} ≤7.5 mA. terminals P1, P2; Function E7, C7.

10) Alarm min., relay contact ≤28 V DC, ≤250 mA, ≤3 W,
passive or optocoupler U_{CE} ≤25 F, I_{CE} ≤7.5 mA. terminals P3, P4; Function E8, C8.

11) forward/reverse direction signal, relay contact ≤28 V DC, ≤250 mA, ≤3 W. terminals 44, 45, 46.

12) Current output, R_L ≤550 Ω 0/4–20 mA, 0–10–20 mA, 4–12–20 mA, R_L ≤1000 Ω 0/2–10 mA,
R_L ≤2000 Ω 0–5 mA. terminals –, +.

13) a) Alarm output, relay contact opens at alarm, ≤28 V DC, ≤250 mA, ≤3 W, terminals V5, V6; Function 39, 40 or

b) Alarm output, optocoupler, U_{CE} ≤25 F, I_{CE} ≤7.5 mA. terminals V5, V6; Function E9, C9.

If a passive scaled pulse output is required in addition to the data link, then the alarm output is not available.

c) Scaled pulse output, optocoupler, U_{CE} ≤25 F, I_{CE} ≤7.5 mA
terminals V5, V6; Function 55, 56 forward.

14) Shielded signal cable (10 m included with shipment from ABB), ABB Part No. D173D018U02.

*) Scaled pulse output, active or passive, pulse width can be set from 0.032 to 2000 ms.

Terminal Designations 20” to 40” [DN 500 to DN 1000]

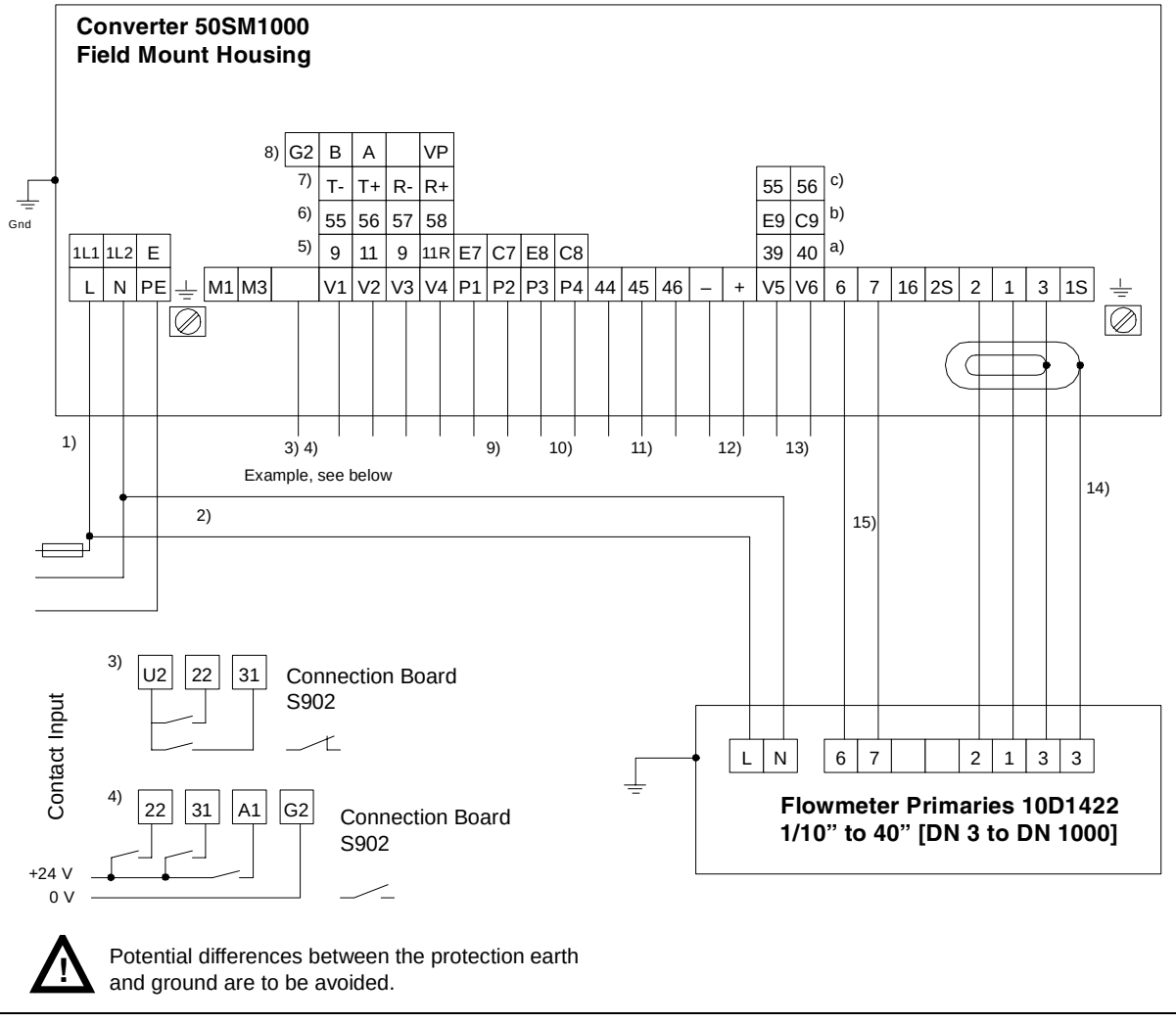
2.6 Retrofitting

The MAG-SM in a field mount housing or in a 19”-Design can also be used to operate the electromagnetic flowmeter primaries Model 10D1422. Only flowmeter sizes 1/10” to 40” [DN 3 to DN 1000] can be retrofitted. The following Interconnection Diagrams can be used for the converter in a field mount housing or in a 19”-Design.

2.6.1 Interconnection Diagram for Retrofitting the Converter 50SM1000 in Field Mount Housing; Flowmeter Primary 10D1422

Note:
Select the flowmeter primary model number in the parameter “Primary Type” in Submenu “Primary” in the converter. Switch S901 on the connection board of the converter in the field mount housing must be opened (see “Connection Board, Field Mount Housing 50SM1000” on Page 38).

WARNING:
The magnet coils are supplied from the line, not from the converter. It is essential that both the flowmeter primary and the converter are connected over a **single** mains switch and a **single** mains fuse.



Potential differences between the protection earth and ground are to be avoided.

Fig.8 Interconnection Diagram, Flowmeter Primary 1/10” to 40” [DN 3 to DN 1000] with Converter in Field mount Housing

1) Supply power, see Instrument Tag.

2) Magnet coil supply from line.

3) External zero return, passive, over contact with internal voltage supply terminals U2 (+24 V DC) and 22. Switch S902 closed.

External totalizer reset, passive over contact with internal voltage supply terminals U2 (+24 V DC) and 31. Switch S902 closed.

4) External totalizer reset with external voltage supply (for galv. isolation) terminals G2 (–) and 31 (+24 V DC). Switch S902 on the Connection Board must be opened.

External zero return with external voltage supply (for galv. isolation) terminals G2 (–) and 22 (+24 V DC). Switch S902 on the Connection Board must be opened.

Dynamic zero compensation with external voltage supply (for galv.isolation) terminals G2 (–) and A1 (+24 V DC). Switch S902 opened. The fluid must be at absolute zero flowrate the metering tube must be completely filled, see 3.3.

5) * Scaled pulse output, 24 V DC active, load ≥150 Ω , fmax 10 kHz
terminals V1, V2; Function 9, 11 forward
terminals V3, V4; Function 9, 11R reverse

6) * Scaled pulse output, passive, relay contact, ≤28 V DC, ≤250 mA, ≤3 W, fmax 20 Hz
terminals V1, V2; Function 55, 56 forward
terminals V3, V4; Function 57, 58 reverse

7) Option, data link RS 485. terminals V1, V2, V3, V4; Function T-, T+, R-, R+.

8) Option, data link Profibus DP, terminals V1, V2, V4, G2, Function RxD/TxD-P(B), RxD/TxD-N(A), +5V (VP), DGND(G2) terminals V4, G2 use only for bus terminations.

9) Alarm max., relay contact ≤28 V DC, ≤250 mA, ≤3 W,
passive or optocoupler U_{CE} ≤25 F, I_{CE} ≤7.5 mA. terminals P1, P2; Function E7, C7.

10) Alarm min., relay contact ≤28 V DC, ≤250 mA, ≤3 W,
passive or optocoupler U_{CE} ≤25 F, I_{CE} ≤7.5 mA. terminals P3, P4; Function E8, C8.

11) Forward/reverse direction signal, relay contact ≤28 V DC, ≤250 mA, ≤3 W. terminals 44, 45, 46 44, 45, 46.

12) Current output, R_L ≤550 Ω 0/4–20 mA, 0–10–20 mA, 4–12–20 mA, R_L ≤1000 Ω 0/2–10 mA, R_L ≤2000 Ω 0–5 mA. terminals –, +.

13) a) Alarm output, relay contact opens at alarm, ≤28 V DC, ≤250 mA, ≤3 W, terminals V5, V6; Function 39, 40 or

b) Alarm output, optocoupler, U_{CE} ≤25 F, I_{CE} ≤7.5 mA. terminals V5, V6; Function E9, C9.

If a passive scaled pulse output is required in addition to the data link, then the alarm output is not available.

c) Scaled pulse output, optocoupler, U_{CE} ≤25 F, I_{CE} ≤7.5 mA
terminals V5, V6; Function 55, 56 forward.

14) Shielded signal cable, already installed. If a new signal cable is required , see Interconnection Diagram 20” to 40” [DN 500 to DN 1000].

15) Reference voltage cable, already installed.

*) Scaled pulse output, active or passive, pulse width can be set from 0.032 to 2000 ms.

Terminal Designations 1/10” to 40” [DN 3 to DN 1000]

2.6.2 Interconnection Diagram for Retrofitting Converter 50SM1000 in 19"-Design; Flowmeter Primary 10D1422

Note:
Select the flowmeter primary model number in the parameter "Primary Type" in Submenu "Primary" in the converter. Switch S901 on the connection board of the converter in the field mount housing must be opened (connection board, see Pages 39 and 40).

WARNING:
The magnet coils are supplied from the line, not from the converter. It is essential that both the flowmeter primary and the converter are connected over a **single** mains switch and a **single** mains fuse.

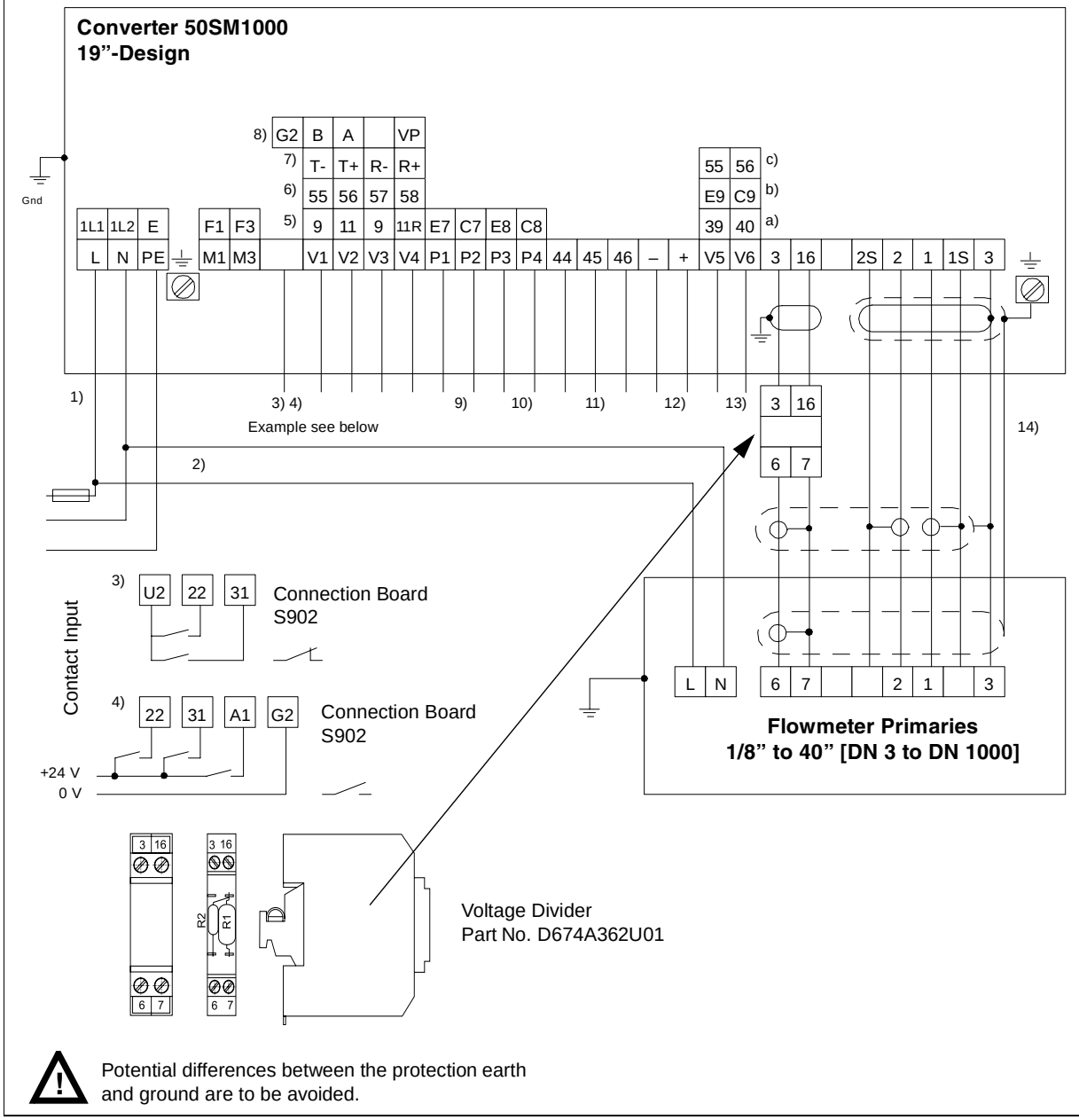


Fig.9 Interconnection Diagram, Converter 50SM1000, 19"-Design, Flowmeter Primaries 1/10" to 40" [DN 3 to DN 1000]

1) Supply power, see Instrument Tag.

2) Magnet coil supply from line.

3) External zero return passive, over contact with internal voltage supply, terminals U2 (+24 V DC) and 22. Switch S902 closed.

External totalizer reset, passive over contact with int. voltage supply, terminals U2 (+24 V DC) and 31. Switch S902 closed.

4) External totalizer reset with external voltage supply (for galv. isolation) terminals G2 (–) and 31 (+24 V DC). Switch S902 on the connection must be opened.

External zero return with external voltage supply (for galv. isolation) terminals G2 (–) and 22 (+24 V DC). Switch S902 on the connection must be opened.

Dynamic zero compensation with external voltage supply (for galv.isolation) terminals G2 (–) and A1 (+24 V DC). Switch S902 opened. The fluid must be at absolute zero flowrate the metering tube must be completely filled, see 3.3.

5) * Scaled pulse output, 24 V DC active, load ≥150 Ω , fmax 10 kHz
terminals V1, V2; Function 9, 11 forward
terminals V3, V4; Function 9, 11R reverse

6) * Scaled pulse output, passive, relay contact, ≤28 V DC, ≤250 mA, ≤3 W, fmax 20 Hz
terminals V1, V2; Function 55, 56 forward
terminals V3, V4; Function 57, 58 reverse

7) Option, data link RS 485. terminals V1, V2, V3, V4; Function T-, T+, R-, R+.

8) Option, data link Profibus DP, terminals V1, V2, V4, G2, Function RxD/TxD-P(B), RxD/TxD-N(A), +5V (VP), DGND(G2) terminals V4, G2 use only for bus termination.

9) Alarm max., relay contact ≤28 V DC, ≤250 mA, ≤3 W,
passive or optocoupler U_{CE} ≤25 F, I_{CE} ≤7.5 mA. terminals P1, P2; Function E7, C7.

12) Alarm min., relay contact ≤28 V DC, ≤250 mA, ≤3 W,
passive or optocoupler U_{CE} ≤25 F, I_{CE} ≤7.5 mA. terminals P3, P4; Function E8, C8.

11) Forward/reverse direction signal, relay contact ≤28 V DC, ≤250 mA, ≤3 W. terminals 44, 45, 46.

12) Current output, R_L ≤550 Ω 0/4–20 mA, 0–10–20 mA, 4–12–20 mA, R_L ≤1000 Ω 0/2–10 mA, R_L ≤2000 Ω 0–5 mA. terminals –, +.

13) a) Alarm output, relay contact opens at alarm, ≤28 V DC, ≤250 mA, ≤3 W, terminals V5, V6; Function 39, 40 or

b) Alarm output, optocoupler, U_{CE} ≤25 F, I_{CE} ≤7.5 mA. terminals V5, V6; Function E9, C9.

If a passive scaled pulse output is required in addition to the data link, then the alarm output is not available.

c) Scaled pulse output, optocoupler, U_{CE} ≤25 F, I_{CE} ≤7.5 mA
terminals V5, V6; Function 55, 56 forward.

14) Shielded signal cable, already installed. If a new signal cable is required , see Interconnection Diagram 20” to 40” [DN 500 to DN 1000].

*) Scaled pulse output, active or passive, pulse width can be set from 0.032 to 2000 ms.

Terminal Designations 1/10” to 40” [DN 3 to DN 1000]

2.7 Interconnection Examples for Peripherals

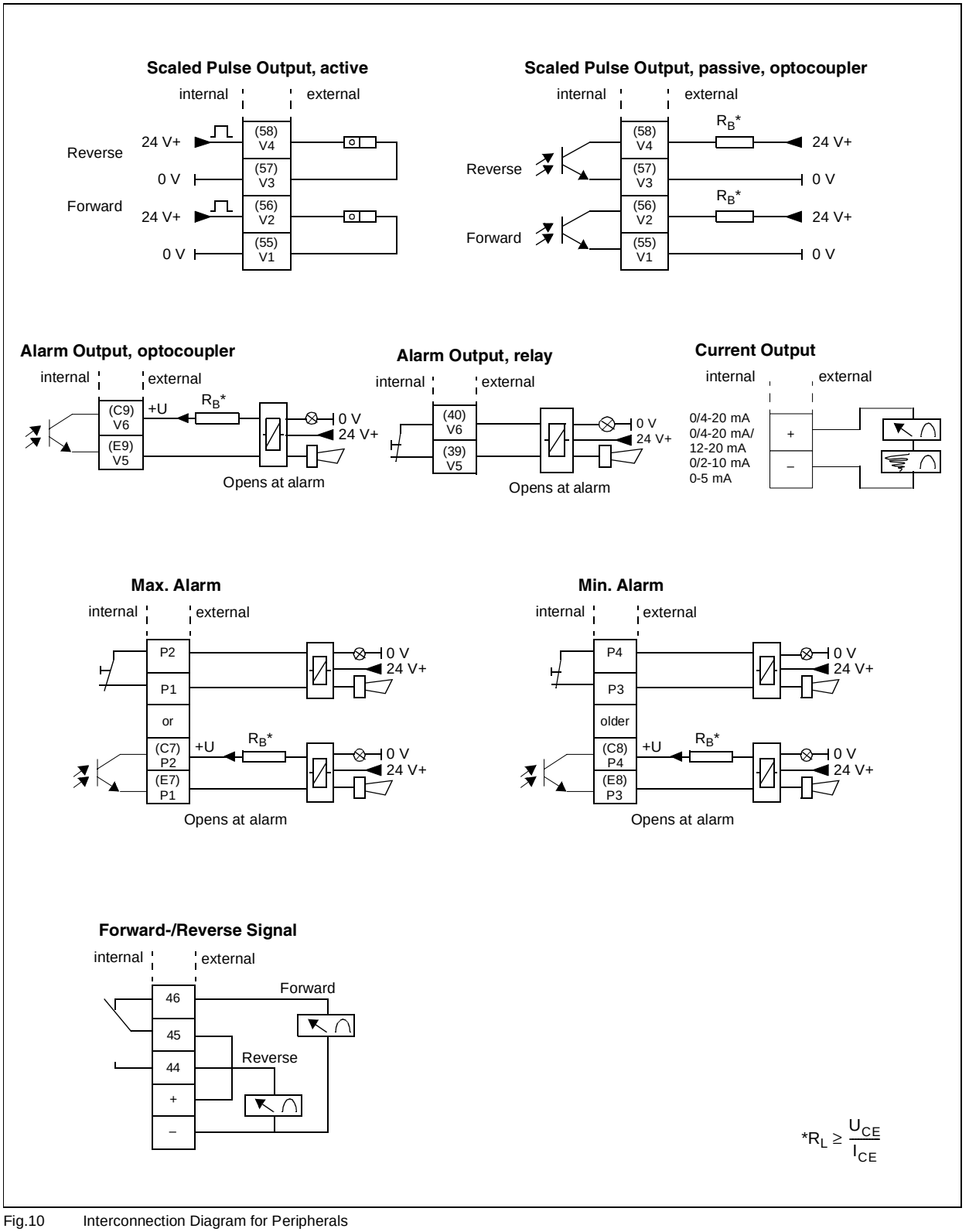


Fig.10 Interconnection Diagram for Peripherals

3. Start-Up

3.1 Preliminary Checks

Before turning on the instrument check that the

- coordination flowmeter primary/converter is correct (essential for converters with fixed ranges and for flowmeter primaries using ac magnetic fields); that the instruments which are to be connected together have the same last number; e.g. A1 connected to B1, X 001 to Y 001 or A2 to B2, X 002 to Y 002 as noted on the Instrument Tag.
- wiring connections are in agreement with the Interconnection Diagrams.
- flowmeter primary has been properly grounded (see Instruction Bulletin for the Flowmeter Primary).
- ambient conditions are within the specified limits.
- supply power values agree with the values listed on the Instrument Tag.
- flow direction coincides with the direction indicated by the arrow on the flowmeter primary.
- parameters are configured for the operating conditions.
- system zero has been adjusted using the software, (see Section 3.2 Zero Check).
- converter parameter “Operating mode” and “Primary type” in the submenu Primary are set correctly. Check the contrast setting on the display. A small screwdriven can be used to adjust the contrast of the display for the local ambient conditions, see Page 53.
- all meter location parameters have been stored in the ext. EEPROM on the connection board. When interchanging a converter module (failure) in the past it was necessary to reenter all the parameters. This is no longer required if the meter location parameters have been stored in the ext. EEPROM on the connection board (see Pages 26 and 38 and Section 5.1.5).

! **Note:**
The values of the settings and the options included with the metering system can be recorded on Page 52 or on the accompanying card. The card is located behind the converter module in the field mount housing. The 4 housing screws must be unscrewed to gain access to the module. The card is tied to the connection board on converter card in the 19”-Insert.

General Information

- If there is no indication of flowrate it may be possible that the singal cable connections are reversed. Interchange the leads connected to terminals 1 and 1S with those at 2 and 2S at the flowmeter primary. For flowmeter primaries with preamplifiers, only the leads connected to terminals 1 and 2 are to be interchanged.
- The locations of the fuses and the fuse values can be found in Figs. 18 to 20.

3.2 Zero Check

At start-up or when checking the system the system zero of the converter should be set. The flowrate in the flowmeter primary must be brought to absolute zero. The metering tube must be guaranteed to be completely filled with fluid. The zero can be adjusted automatically or manually by using the parameter “System zero”. Select the parameter with ENTER and use the arrow keys to select “automatic”, if desired, and activate by pressing the ENTER. During the automatic adjustment procedure the converter counts from 0 to 256 and the counts displayed in the 2nd line while the adjustment is executed 7 times. The system zero adjustment then terminates. The adjusment prodedure takes approx. 20 seconds and the zero value should be within the range of ±1500 Hz.

3.3 Dynamic Zero Compensation

An automatic zero adjustment can be initiated from the converter input (terminals A1 – G2). The flowrate in the flowmeter primary must be brought to absolute zero. The metering tube must be guarantedd to be completely filled with fluid.

During the automatic adjustment procedure the converter counts from 2 to 256 and the counts displayed in the 2nd line while the adjustment is executed 7 times. The zero value should be within the range of ±1500 Hz.

If the adjustment value is outside of these limits – causes: large noise signals (check ground connections), fluid level unsteady (hydraulic problems, shut off device leaks), metering tube not full (pipeline can drain, shut off device leaks) – the message “Warning” is displayed in the 1st line of the converter. This message can only be cleared by pressing the ENTER-key.

4. Maintenance

The converter is maintenance free. Observe the “Introductory Safety Notes for the EMF System” and the “Hazardous Material Information” at the beginning of this Instruction Manual.

5. Data Entry

5.1 General Description

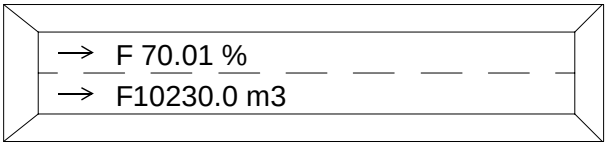
Note:
An illustration and description of the converter keypad may be found on Page 53.

The instantaneous flowrate is displayed in the first line in percent or direct reading engineering units together with the present flow direction indicator, → F for forward or ← R for reverse) .

In the second line the totalizer value for the present flow direction is displayed with a max. of seven digits followed by the units.

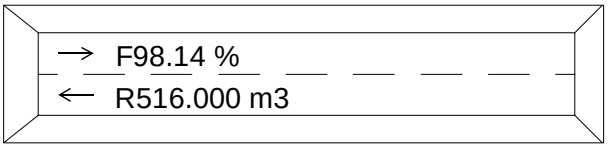
The totalizer value, in the appropriated units, always represents the actual value regardless of the pulse factor setting.

This display combination is referred to in the text by the term process information.



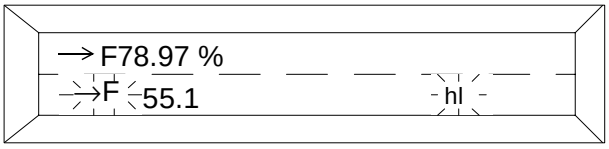
1st line Forward direction instantaneous flowrate
2nd Line Forward direction totalizer value

The totalizer value for the other flow direction can be displayed by pressing the Tot-key. After apporx. 20 seconds the display automatically switches back to displaying the totalizer value for the present flow direction. The display can be switched back immediately by pressing the Tot-key again.



1st Line Forward direction instantaneous flowrate
2nd Line Reverse direction totalizer value
(Press Tot-key, multiplex operation)

A totalizer overflow occurs whenever the totalizer value reaches 9,999,999 units. When the totalizer value in one of the flow directions is greater than 9,999,999 units, the flow direction symbol (→ F or ← R) and the units (e.g. **hl**) blink in the 2nd line. The totalizer value is reset to 0 and the internal overflow counter incremented by 1.



1st Line Forward direction instantaneous flowrate
2nd Line Totalizer overflow. → F and hl blink

A converter software counter can register a max. of 255 overflows.

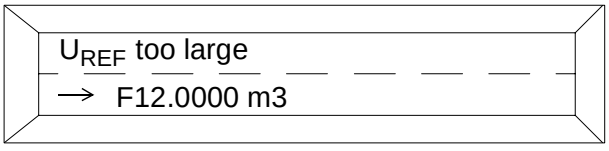
A calculation for an overflow condition is shown in Section 5.2. on Page 19.

The overflow indicators can be cleared independently for each flow direction with ENTER.

When no overflow counter value is displayed the converter resets the appropriate totalizer value.

If an error condition exists, an error message is displayed in the first line.

The error message is displayed alternately in clear text and then with its error code. Only the error with the highest priority is displayed in clear text while the error codes for all detected errors are displayed in the alternate display. See Error Messages and Checks beginning on Page 35.



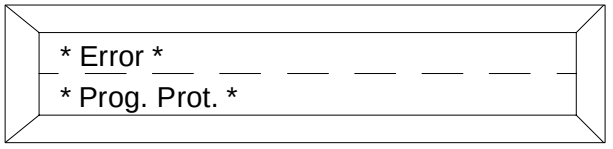
1st line: Error with the highest priority at the present time; (instrument is inoperative) The alarm output is activated (opened). See Table Error Messages on Page 35.

2nd line: Forward direction totalizer value

5.1.1 Data Entry Information

Special programming knowledge is not required for entering data.

Settings and data can only be entered or changed when the converter program protection has been turned off. Whenever the power is turned on the program protection is automatically turned on, i.e., no settings or values can be changed. If an attempt is made to make changes while the program protection is turned on, the following message is displayed:



Operating parameters can be accessed by pressing the appropriate direct access key or by using the arrow keys to scroll in either direction through the menu. The name of the parameter is displayed in the first line and its present value in the second line together with its units.

The converter remains on-line during data entry, i.e., the current and pulse outputs continue to indicated the present operating conditions. Any control devices connected to the converter need not be set to manual when parameters are viewed or changed. No data is lost in the internal and external pulse totalizers.

5.1.2 Direct Numeric Entries

Use the arrow keys to access the program protection and select » Off « with ENTER.

Parameters can only be changed when the program protection is turned off. Data is entered using the following procedure:

1. Access the desired parameter by pressing the appropriate key. The parameter is displayed in the 1st line and its value in the 2nd line.
2. When the » ENTER « key is pressed the text displayed in the 1st line remains unchanged while the parameter value in the 2nd line is cleared and replaced by a blinking cursor. The converter waits for data to be entered. If no data is entered within approx. 20 seconds the old value is redisplayed and after an additional period of time the process information display reappears.

3. The data is entered beginning with the most significant number. The new value is accepted and stored in the computer when the » ENTER « key is pressed. As a check, the new value is displayed. If an incorrect entry has been made it can be cleared by pressing the » C/CE « key. To immediately return to the process information display press the » C/CE « key, otherwise the display returns automatically after approx. 20 seconds.

3.1 The computer checks the data entered after the » ENTER « key is pressed. If the data value is outside of the allowable setting range an error meessage is displayed and the old data is retained. The message can be cleared and the old value redisplayed by pressing the » C/CE « or » ENTER « key. The value can be cleared as described above.

5.1.3 Entries from a Table

After initiating the procedure with » ENTER « the arrow keys can be used to find the desired value in the table. When the value is found it can be accepted by pressing the » ENTER « key. The value is checked for plausibility. The routine can be interrupted at any time by pressing the » C/CE « key.

5.1.4 Terminating Data Entry

The entry is cleared by pressing the » C/CE « key. Pressing the » C/CE « key again displays the value of the old setting and pressing the » C/CE « key once more redisplays the process information.

After data entry has been completed the program protection should be turn on. Find the parameter “Program protection”. Press the » ENTER « key.

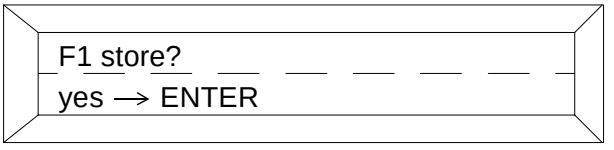
The program protection is turned on.

5.1.5 Data Security

All data is stored when the power is turned off or interrupted in a NV-RAM. The parameter settings, process information and flowmeter primary specific calibration data are stored in a serial EEPROM as well as in an external EEPROM. If a converter module exchange is necessary it is possible to upload all the data from the external EEPROM into the new converter module.

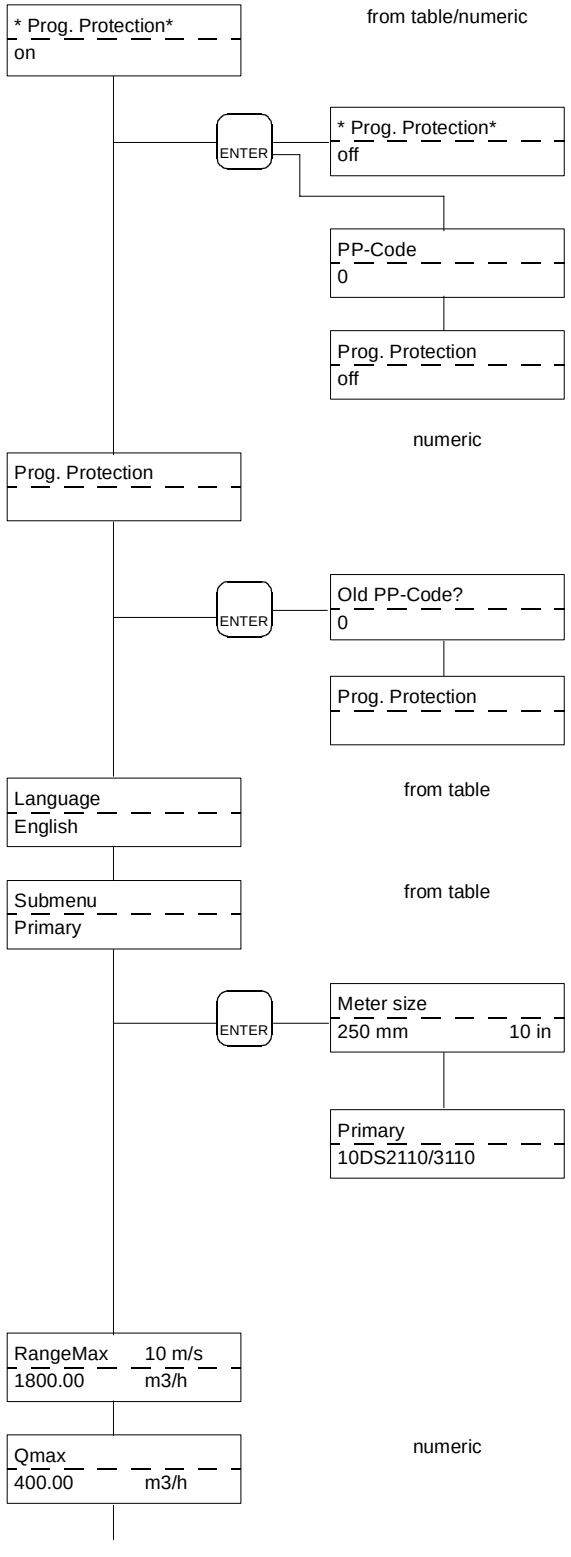
5.1.6 Double Function Keys F1–F4

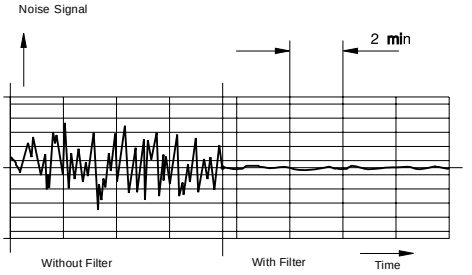
The keys F1–F4 can be configured as double function keys and assigned a parameter selected by the user. Select the parameter to be assigned using the arrow keys and then press and hold the F1 key for at least 5 seconds. The F2 - F4 keys can be programmed similarly.
The parameters assigned to the double function keys F1 - F4 can be recorded on Page 53.

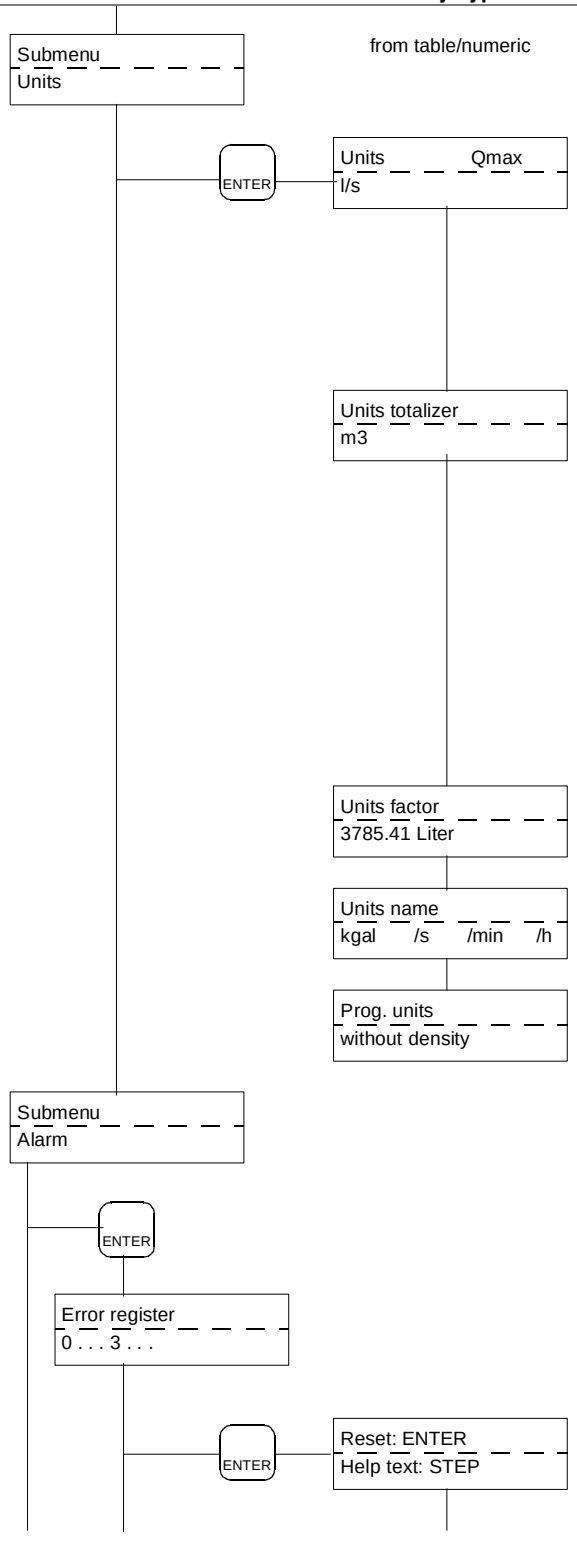


The user selected parameter for the double function are assigned by pressing the » ENTER « key.

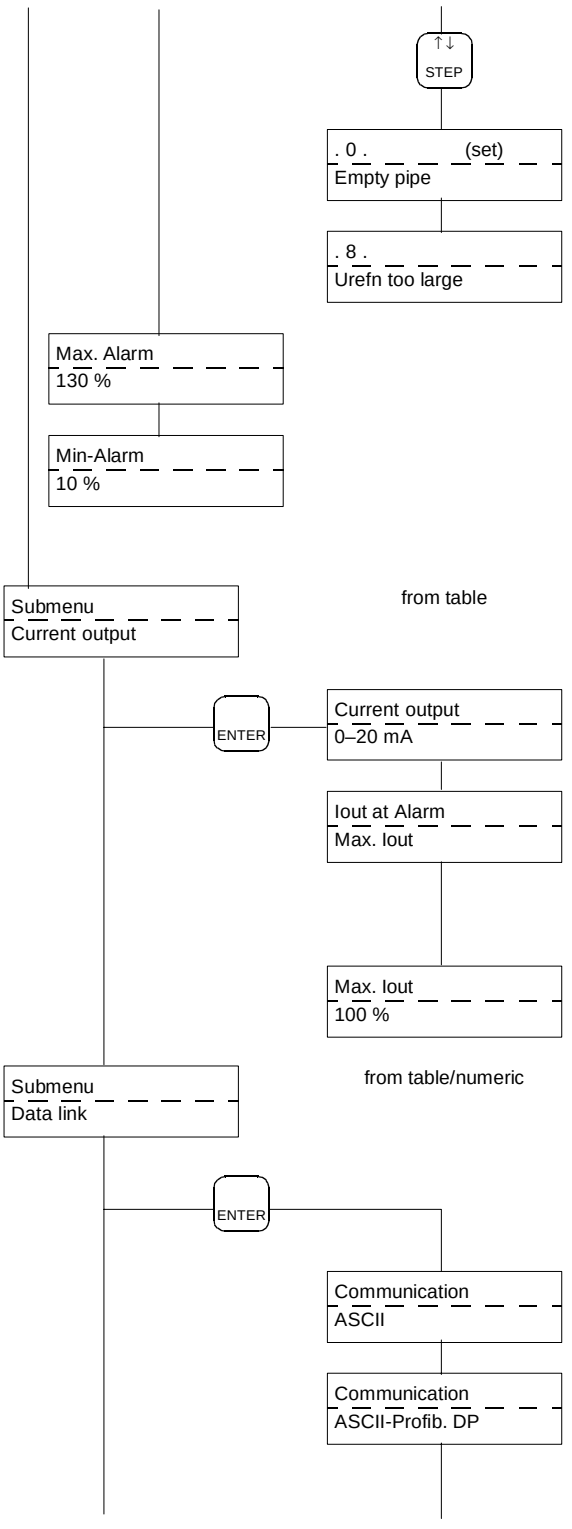
5.2. Parameter Overview Standard Software (HART-Protocol see Page 33) and Data Entry



Submenu/Parameter	Entry Type	Comments
Pulse 1.000 /m3	numeric	Pulse factor for int. and ext. flow totalization, Range 0.001–1000 pulses per selected flow unit, max. count frequency 10 kHz. Note: The max. count frequency and the pulse factor are checked by the software, if out of range Error 40 “Frequency >10 kHz” is displayed.
Pulse width 30.000 ms	numeric	For external pulse output. Range: 0.0032 ms – 2000 ms in multiples of 0.0032 ms. The max. allow. pulse width is checked by the software and corrected if required.
Low flow cutoff 1.000 %	numeric	Range 0–10 % of the flow range end value setting, applies to the displayed values and all outputs. The switching limits for the zero return incorporate a hysteresis of 0.5 %.
Damping 10.0000 s	numeric	Range 0.100–99.99 s. Response time for 5 τ = 0–99 % flowrate change.
Filter on	from table	 On/off. Standard is off. If the output signal is noisy, turn the filter on and select a damping time > 2.4 sec. For applications with piston or diaphragm pumps (pulsating flow) a special algorithm is required. Faster flowrate measurements are achieved at this higher excitation frequency and utilizing difference totalizers so that the reverse flow values can be subtracted, i.e. the totalizer runs in reverse. The filter should be set to “On” for pulsating flows applications (for a pulsation free output).
Density 2.54300 g/cm3	numeric	Range 0.01–5 g/cm^3. Mass flowrate display and totalization in g, kg, t, uton or pounds.
System zero 3.5 Hz	from table/numeric	C/CE Exit the submenu
ENTER → Adjust? yes → ENTER		Zero value check (required when retrofitting older flowmeter primaries).
Adjust Manual		Manual entry, e.g. when a converter is exchanged.
Adjust Automatic		Valve must be closed, flowrate must be at 0. The automatic adjustment is initiated with ENTER. The zero value limits are ±1500 Hz. If the value exceeds these limits, the zero adjustment value is not accepted.

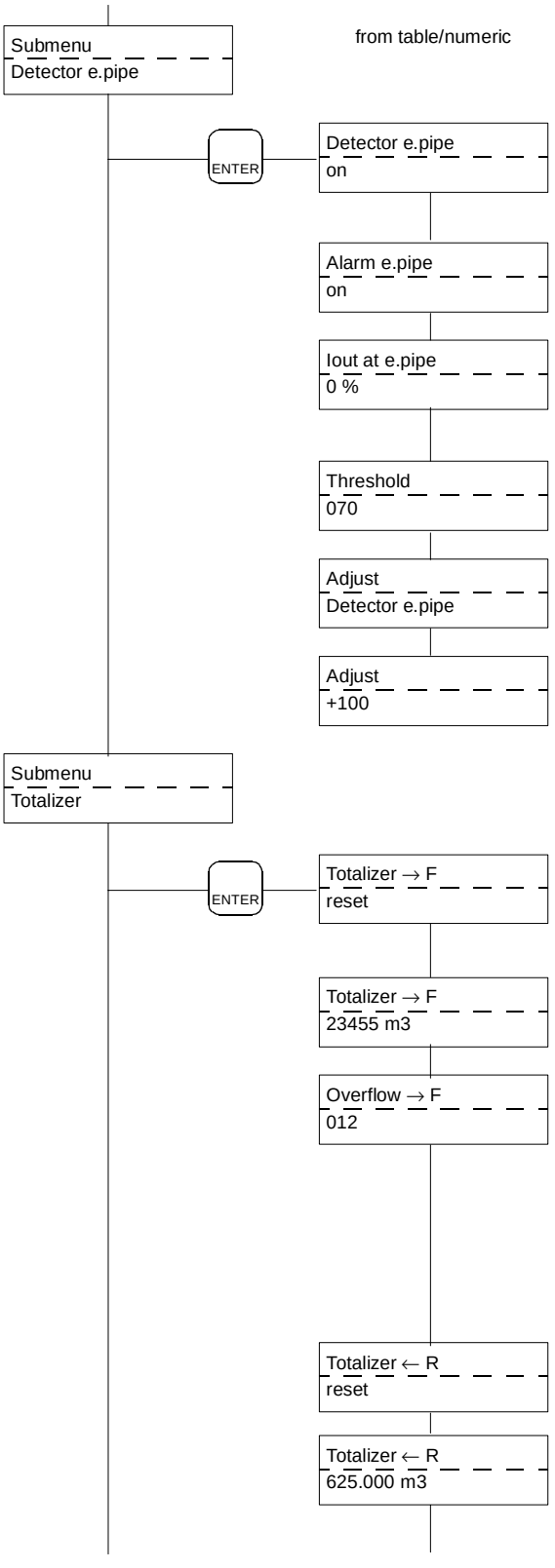


Submenu/Parameter	Entry Type	Comments
Submenu Units	from table/numeric	C/CE: Exit the submenu
Units Qmax	l/s	Selectable flowrate units ml/s, ml/min, ml/h, Ml/h, Ml/min, Ml/day, lb/s, lb/min, lb/h, uton/min, uton/h, uton/day, l/s, l/min, l/h, hl/s, hl/min, hl/h, m^3/s, m^3/min, m^3/h, igps, igpm, igph, mgd, gpm, gph, bbl/s, bbl/min, bbl/h, bls/day, bls/min, bls/h, kg/s, kg/min, kg/h, t/s, t/min, t/h, g/s, g/min, g/h, kgal/s[1)], kgal/min[1)], kgal/h[1)] The units apply to Rangemax, Q_{max} and the displayed flowrate indication, when a display in engineering units has been selected.
Units totalizer	m3	ml, l, hl, igal, gal, mgal, bbl, bls, kg, t, g, Ml, lb, uton, kgal[1)]. [1)] Factory default setting for user programmable units The totalizer units selected are automatically checked as a function of the flow range, the pulse factor (0.001 to 1000 pulses/unit), the pulse width (0.032 ms to 2000 ms) and the density correction factor, when mass units (e.g. g, kg, t) have been selected. If any of these parameters are changed, the pulse width may not exceed 50% of the output frequency at 100% flowrate (on/off ratio 1:1). If the pulse width is too large, it will be automatically reduced to 50 % of the period and the message “Warning: New Pulse Width” displayed. Also values which are outside of the output frequency limits are indicated by appropriate messages in the display and automatically corrected.
Units factor	3785.41 Liter	User programmable flowrate units, based on liters; Value in example applies to kgal units (factory default setting). More detailed information can be found in Section 5.3.1 on Page 27.
Units name	kgal /s /min /h	A four character name for the user programmable units. kgal = factory default setting
Prog. units	without density	Programmable units for mass flowrate (with density) or volume flowrate (without density)
Submenu Alarm		C/CE: Exit the submenu
Error register	0 . . . 3 . . .	All detected errors (Errors 0–8) are stored (once).
Reset: ENTER	Help text: STEP	The error register can be cleared by pressing ENTER.

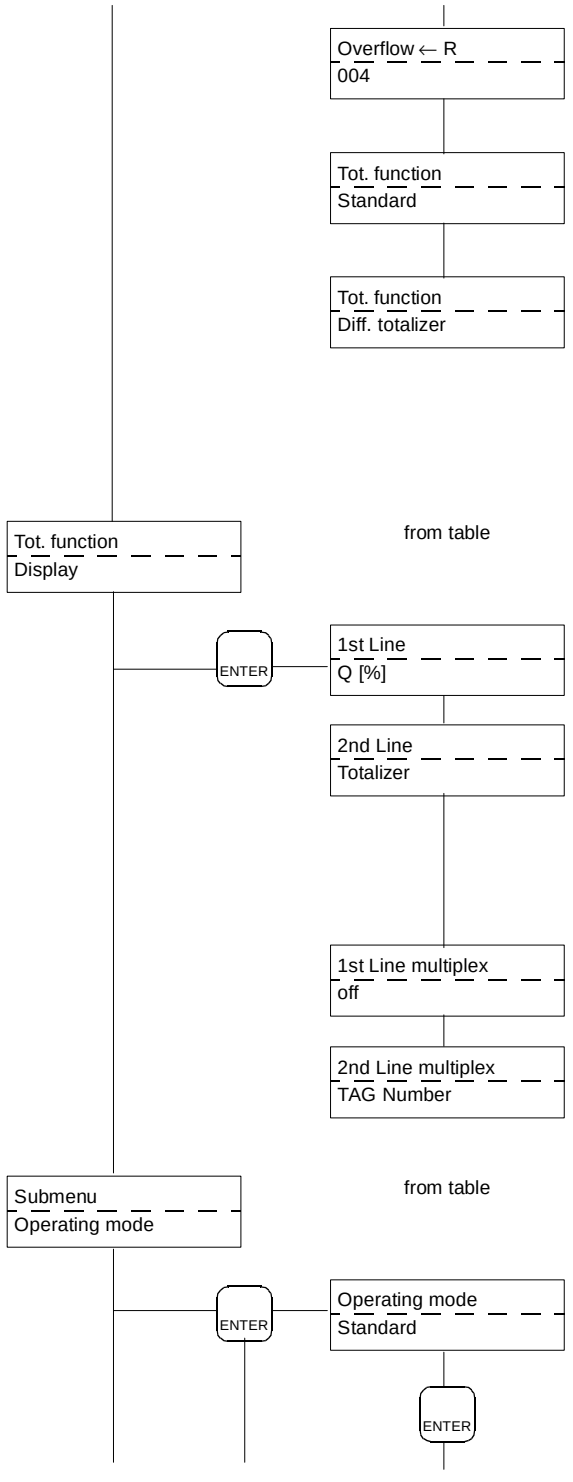

Submenu/Parameter
Entry Type
Comments
↑↓ STEP
. 0 . (set)
Empty pipe
. 8 .
Urefn too large
Max. Alarm
130 %
Min-Alarm
10 %
Submenu
Current output
from table
ENTER
Current output
0–20 mA
Iout at Alarm
Max. Iout
Max. Iout
100 %
Submenu
Data link
from table/numeric
ENTER
Communication
ASCII
Communication
ASCII-Profib. DP
C/CE
Help text information, exit by pressing C/CE.
After pressing the STEP-key a clear text description for each error code number is displayed. Active errors are indicated by the text "(set)".
Press the C/CE-key to exit the help text information. Additional information about the error messages and corrective measures may be found in Section 6.3.
Alarm, range 0–130 % of the flow range setting. Can be set in 1 % steps. Switching hysteresis 1 %. The message is displayed by a blinking arrow " ↑ ".
Alarm, range 0–130 % of the flow range setting. Can be set in 1 % steps. Switching hysteresis 1 %. The message is displayed by a blinking arrow " ↓ ". If both errors have occurred, a blinking double arrow is displayed.
C/CE
Exit the submenu
Selections: 0–20 / 4–20 mA / 0–10 mA / 2–10 mA / 0–5 mA / 0–10–20 mA / 4–12–20 mA
For HART-Protocol always 4–20 mA,
Current output during an alarm condition. Selections: 0 %, 3.6 mA or Max. Iout. The MAX setting can be used to set the current output limit to 100 %, 115 % or 130 %. For Error 3 the selected value is displayed and the current output is fixed at the selected value. If Error 0 (empty pipe) occurs, the current output is set to the value set in the submenu "Detector Empty Pipe" in the parameter "Iout at Empty Pipe".
C/CE
Exit the submenu
The submenu data link is only displayed when a RS 232C or RS 485 Module has been installed in the converter and recognized. Details for ASCII or µ DCI communication can be found in the appropriate Instruction Bulletins.
Communication protocols: ASCII, ASCII-Profibus DP, ASCII-SM1 mode, Print 5 Batch, Print 6 continuous (printer reports) or µ DCI Binary over the data link RS 485.
ASCII-Profibus DP
When this protocol is selected the instrument address is set to 0 and the transmission speed to 4800 baud. In addition the TAG-Number is set to 125.

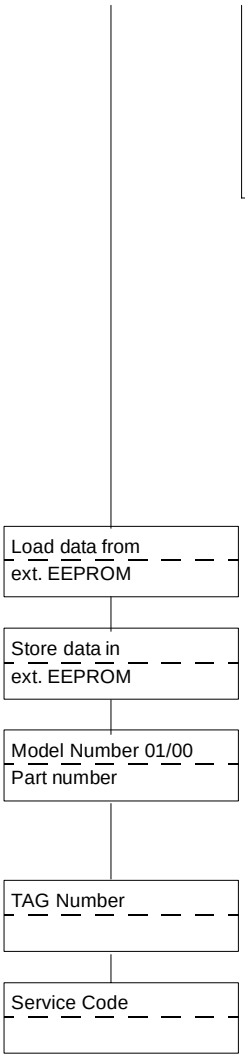
Submenu/Parameter	Entry Type	Comments
	Slave-Addr. 126	The Slave-Address must be entered as a three digit number, address range 000, 001 to 126. If a bus address is entered as a one or two digit number incorrect interpretation of the bus address by the converter will result.
	Function Param.-Profib. DP	This function is used to access the parameters from the Profibus DP-Module. See also Section 13 „Functions in the Data Link Menu“ in the Profibus Data Link Description, Part Number D184B093U03.
	Communication ASCII-SM1 mode	ASCII-SM1000-Mode In this protocol the contents of the Error Register can be transmitted bitwise.
	Communication µDCI-Binary	µDCI-Binary-Protocol Compatible with the µDCI-Family (process automation)
	Instr. address 004	Instrument Address: 0–99 (not available when Printer protocols are selected). If multiple instruments are connected to a single bus (RS 485), each instrument connected to the bus must have a unique address.
	Baudrate 2400 Baud	Baudrate: Selection range 110–28800 Baud.
	Printer type Standard	This parameter is only displayed when a printer protocol has been selected. Either a standard printer type[1] or the Report Printer ABB 55DE1000 can be selected.
	Print time	This parameter is only displayed when a printer protocol and the ABB 55DE1000 Printer have both been selected. Entries for the Protocol Printer: Year, Month, Day, Hour, Minute
Submenu Function test		C/CE Exit the submenu
ENTER	Function test I_{out}	Function test current output, enter data mA. Function test Fout See Section. 5.4 on Page 27
	Function test VNVRAM, 22C12	Function test internal subassemblies, automatic tests of NVRAM, EPROM 27C512, EEPROM 93C46, ext. EEPROM 93C46. Additional test functions: Alarm contact, F/R-contact, terminals P1/P2, terminals P3/P4, input A1, input A2, data link, Profibus, F_{out}, display, Ext. zero return and totalizer reset.

1) Minimum requirements for a Standard Printer
40 characters/line, 1 kByte printer buffer, compatible ASCII-character set.
Handshaking (e.g. XON/XOFF) is not utilized.
A print output of the report is initiated over the ext. totalizer reset contact input, terminals G2/U2-31.



Submenu/Parameter	Entry Type	Comments
Submenu Detector e.pipe	from table/numeric	**! Note:** For trouble free operation the function “Detector Empty Pipe” should only be used for fluid conductivities above 20 µ S/cm and meter sizes 3/8” [DN 10] and up. Not available for MAG-CS.
Detector e.pipe on	ENTER	off = Empty pipe detector turned off on = When the metering tube empties, a message is displayed and the alarm contact is activated when the alarm is set to “on”
Alarm e.pipe on		off = No alarm output signal for “Empty Pipe” detection. on = Alarm output signal activated for “Empty Pipe”.
Iout at e.pipe 0 %		Iout at empty pipe: output set to 0 %, Max or 3.6 mA. Independent of the settings in the parameter “Alarm e.pipe”. Iout is always set to its alarm value and an error message is always displayed.
Threshold 070		Set threshold value. $\frac{\text{Adj. value filled + Adj. value empty}}{2}$
Adjust Detector e.pipe		The converter displays the adjustment value in the 2nd line.The pipeline must be filled. Set the adjustment potentiometer R813 to +100 (pot located on the DEP module). Empty pipeline, note new adjustment value, set calculated threshold sensitivity value.
Adjust +100		
Submenu Totalizer	C/CE	Exit the submenu
Totalizer → F reset	ENTER	The forward totalizer can be reset by pressing the ENTER-key. If the overflow counter > 0, Overflow → F Reset is displayed. **Note:** If the totalizer function “Difference Totalizer” has been selected, Difference Totalizer Reset is displayed.
Totalizer → F 23455 m3		Preset totalizer, difference totalizer 2nd display line = present value (e.g. after a converter exchange).
Overflow → F 012		Overflow counter max. 250, 1 Overflow = totalizer value >9,999,999 units (display is reset and overflow counter incremented by 1). **Overflow Calculation Example** Overflow 012 12 x 10,000,000 Units = 120,000,000 Units + 23,455 Present totalizer value = 120,023,455 Units
Totalizer ← R reset		See forward totalizer
Totalizer ← R 625.000 m3		See forward totalizer


Submenu/Parameter
Entry Type
Comments
Overflow ← R
004
See forward direction overflow counter
Tot. function
Standard
Tot. function
Diff. totalizer
The totalizer function is automatically set as a function of the selections in the "Operating Mode" submenu.
Operating mode Standard = Totalizer function Standard;
Operating mode Piston Pump = Totalizer function Difference totalizer
Standard = For "Totalizer Function Standard" the forward and reverse flows are totalized on two separate totalizers. If forward flow direction only is selected, only the forward totalizer is activated.
Difference totalizer = A single totalizer is used for both flow directions. The flow is added in the forward direction and subtracted in the reverse direction. When the totalizer value is negative, i.e. the reverse flow totals are larger than the forward flow totals, the direction indicator in the display changes from " →F" to " ←R". The pulse outputs (active or passive) are not affected by these settings.
Tot. function
Display
from table
C/CE
Exit the submenu
ENTER
1st Line
Q [%]
Process Information: Various values can be selected, (independently for each line), for the process information display:
Q [%] Flowrate in %
Q [Units] Flowrate in direct reading engineering units
Q [mA] Flowrate in mA
Q [m/s] Flowrate in m/s
Bargraph Flowrate as a bar graph
Totalizer Totalizer values for forward/reverse or only forward-, reverse-, or difference totalizer values. (for piston pump operating mode)
TAG-No. Meter identification number
off No function (only for multiplex mode)
Blank line Only for 2nd line
2nd Line
Totalizer
1st Line multiplex
off
In the multiplex mode an additional value can be displayed in the 1st line.
Displays are switched every 15 seconds.
For selections see display 1st line.
2nd Line multiplex
TAG Number
See 1st Line Multiplex
Submenu
Operating mode
from table
C/CE
Exit the submenu
ENTER
Operating mode
Standard
Operating mode "Standard" is to be selected for continuous flowrate measurements.
ENTER

Submenu/Parameter	Entry Type	Comments
	 numeric numeric	Operating mode **"Piston Pump"** for pulsating flows. In this operating mode an improved reproducibility is achieved in the flow signal measurements for pulsating flows in piston pump applications. In order to realize a quiet instantaneous flow indication and a smooth current output a special software filter can be activated in the converter. The filter should be turned "on" for piston pump operation. The damping time should be selected greater than 2.4 s, otherwise the software filter will not be operational. Selection of the flow direction Forward/reverse or forward only If the flow is in the reverse direction when forward only is selected, the flow direction indicator ← "R" in the display blinks and the flowrate is set to 0 %. Normal/Inverse Reverse the forward/reverse flow direction indicators. See display. When a converter is exchanged the meter location parameters can be uploaded into the replacement converter. After the start-up configuration has been completed or after instrument settings have been changed, the new or revised parameter settings can be stored in the external EEPROM. Software version In the 1st line the instrument designation is displayed together with the revision date of the software 01/00. In the 2nd line the software designation (D699B154U01, for HART D699B164U01) and the software version are displayed. An alphanumeric meter identification TAG-Number, with up to 16 characters, can be entered utilizing lower and upper case letters and numbers. Only for ABB Fischer & Porter Service.

5.3 Parameter Entry (Additional Information)

5.3.1 User Programmable Units

With this function it is possible to program any desired units in the converter. The following three parameters are included in this function:

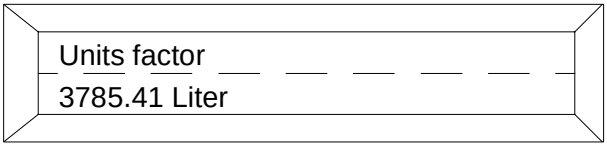
a) Units factor
b) Unit name
c) Programmable units with/without density

! Note:

Entering data in the parameters a), b) and c) is only necessary if the desired direct reading engineering units are not listed in the Table integrated in the converter see Page 21.

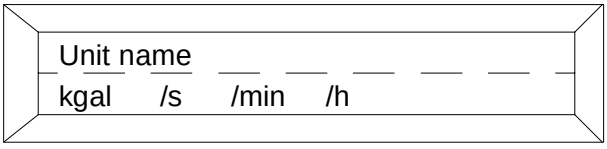
5.3.2 Units Factor Numeric Entry

The value in this parameter is equivalent to the number of liters in the new unit. Shown is kgal = 3785.41 Liter.



5.3.3 Unit Name Select from Table

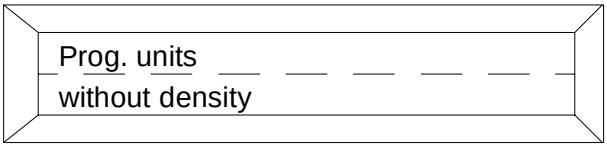
The selection is made with the STEP and DATA keys. Scroll back and forth through the alphabet with DATA. Use the number keys (0...9) to shift the cursor location.



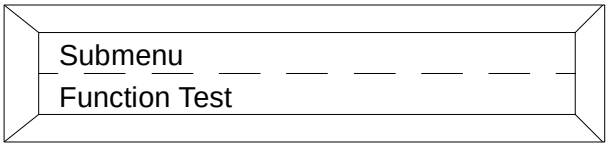
The time units /s, /min and /h can be assigned to the entered engineering unit.

5.3.4 Programmable Units Select from Table

This function is utilized to indicate whether the newly programmed units are mass units (with density) or volume units (without density). If “with Density” is selected, see also Page 21.



5.4 Submenu Function Test Numeric Entries only for I_{out} and F_{out}



The Function Test offers 16 functions to test the instrument independent of the instantaneous flowrate.
In the Function Test mode the converter is no longer on-line (current and pulse outputs do **not** indicate the existing operating conditions). The individual test routines can be selected using the STEP and DATA keys.

I_{Out}, NVRAM 22C12, EPROM 27C512, EEPROM 93C46, ext. EEPROM 93C46, alarm contact, F/R contact, terminals P1/P2, terminals P3/P4, input A1, input A2, data link, Fout, display, ext. zero return and totalizer reset.

The function tests can be terminated by pressing C/CE.

Select **I_{out}** and press ENTER and enter the desired value in mA. Monitor the output value at terminals + and - with a digital multimeter (mA range) or with the process instrumentation.
Note: No automatic return to process metering. Terminate using C/CE key.

Select **NVRAM 22C12** and press ENTER. The converter automatically tests the NVRAM and displays its diagnosis.

Select **EPROM 27C512** (program memory) and press ENTER. The converter automatically tests the EPROM and displays its diagnosis.

Select **EEPROM 93C46** and press ENTER. The converter automatically tests the EEPROM and displays its diagnosis.

Select **Ext. EEPROM 93C46** and press ENTER. The converter automatically tests the ext. EEPROM and displays its diagnosis.

Select **Alarm Contact** and press ENTER. The alarm contact can be toggled on and off using the STEP or DATA key. Monitor terminals V5 and V6 with an ohmmeter (if a simulator is being used for the test; the operate LED on the simulator indicates on/off).

Select **F/R-Contat** and press ENTER. Manually actuate the forward/reverse output.

Select **Terminals P1/P2** and press ENTER. The contact can be manually toggled on and off using the STEP or DATA key.

Select **Terminals P3/P4** and press ENTER. The contact can be manually toggled on and off using the STEP or DATA key.

Select **Input A1** and press ENTER. A status request of input A1 can be activated.

Select **Input A2** and press ENTER. A status request of input A2 can be activated.

Note: No automatic return to process metering. Terminate using C/CE key.

Data Link Test

Before initiating the test connect the transmitter to the receiver at the connection terminals. The computer sends 1000 ASCII-Code 31 hex characters and monitors the received characters. On the left side of the display the number of characters sent is displayed. On the right side the number of characters received is displayed. After 1000 characters are transmitted the computer no longer monitors the received characters but continues to send the 31 Hex character until the C/CE key is pressed.

Select **Data Link** and press ENTER. The test runs automatically.
Note: No automatic return to process metering. Terminate using C/CE key.

Select **Fout**, press ENTER and enter the desired value in Hz. Monitor the ouptut value at terminals 8D and 31 (TP 14 and 31 in the 19"-Design) for agreement with the entered value. Frequency range from -13000 Hz to 13000 Hz. For positive frequency value entries (flowrate 100 % = 10 kHz) the forward direction totalizer pulses can be monitored (consider the totalizer settings; pulse factor, pulse width and totalizer units) at terminals V1 - V2 (if testing with a simulator, at jacks 9/11). For negative frequency value entries (with a minus sign) the reverse flow direction totalizer pulses can be monitored at terminals V3 - V4 (if testing with a simulator, at jacks 9/11R).
Note: No automatic return to process measurements. Terminate by pressing C/E-key.

Select **Display** and press ENTER. The converter writes the numbers 0 to 9 and the letters A to F in the 1st and 2nd lines of the display. Visually monitor for proper operation of the dot matrix.

Select **Ext. Zero Return** and press ENTER. Jumper input G2 to 22 or U2 to 22 (note switch S902 setting on the connection board), the converter responds off/on.
Note: No automatic return to process measurements. Terminate by pressing C/E-key.

Select **Totalizer Reset** and press ENTER. Jumper input U2 to 31 or G2 to 31 (note switch S902 setting on the connection board), tne converter responds off/on.
Note: No automatic return to process measurements. Terminate by pressing C/E-key.

5.5 Communication with the Field Instruments Using Operator and Monitoring Stations

Two different communication technologies are available for data exchange between the MAG-SM electromagnetic flowmeter and a process control system, computer, PC or SPC. A special RS 485/Profibus DP data link option is available for the converter or a HART-Protocol option which does not require any additional installation expenses.

5.5.1 Serial Data Transmission with RS 485

All parameter settings, measurement values such as the instantaneous flowrate and totalizer value, as well as system monitoring can be accessed during on-line operation. From a PC or a direct connection to the converter the converter can also be reconfigured.

A bus system can be structured using the serial RS 485 data link. Distances up to 1200 m are possible between the electromagnetic flowmeter converter and the process control device. Up to 32 instruments can be connected to a single bus and can be operated on-line.

RS 485

Level = 5 V. Input impedance: ≥ 12 k Ω ,
Cable length ≤ 1200 m,
Baudrate: 110-9600 Baud, 14400/28800 Baud.
Max. 32 instruments in parallel on a single bus. A shielded data cable with individually twisted pairs is recommended.
Terminals V1, V2, V3, V4 Function T-, T+, R-, R+

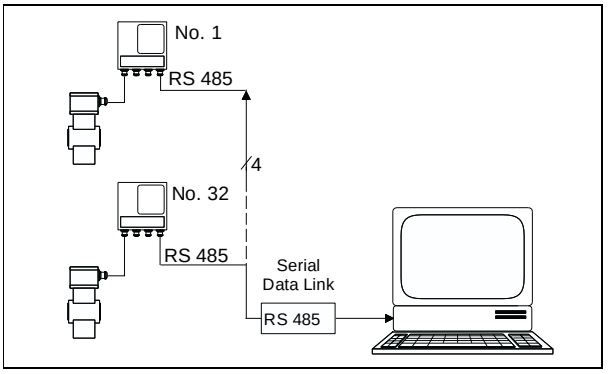


Fig.11 Communication with a RS 485 Data Link

Three software data link protocols and a printer protocol are available.

Communication Protocol ASCII

Communication is always inititated by the host computer. The converter responds only to the specific command sent from the host computer.

Converter data can be accessed (Monitor Mode) or reconfigured (Programming Mode). ASCII information is described in a separate "ASCII-Communication" document.

Communication Protocol Profibus DP per DIN 19245

Communication during on-line operation using stadardized Profibus DP Process Control technology. A list of the supported communication objects and their definitions can be requested.

The cable types described in DIN 19245, Part 1 and Part 3 are generally used for this communication technology, see Part 3, Table 3 and Table 4.

Terminal Designations:

Terminal	Function	Reference
V1	B RxD/TxD-P	Receive/send data - P
V2	A RxD/TxD-N	Receive/send data - N
V4	VP	Supply voltage Plus P5V
G2	C DGND	Data refernce potential; M5V

Shield connected to housing

Cable

A shielded and twisted data cable is recommended.

Max. cable length 1200 m (Cable type A)
Characteristic impedance 135-165 Ohm
Max. 32 instruments per segment
Max. 124 instruments on a single bus, total
Baudrate: 9.6-1500 kbit/s
Distributed capacitance <30 pF/m, loop resistance 110 Ω/km
Max. tap line length 1 m.
In- and outgoing cables connected to the same terminals.

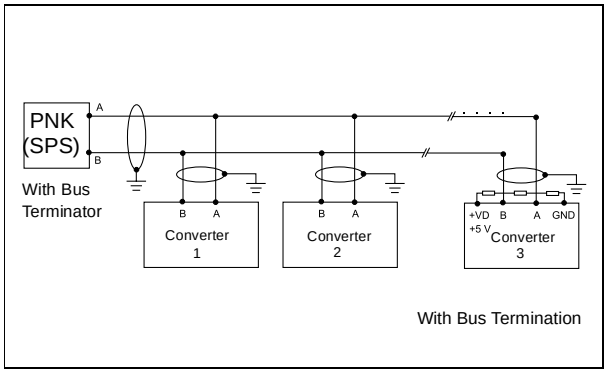


Fig.12 Bus Termination Profibus DP

Cable Terminations:

Both ends of the bus cable must be provided with a bus termination. In addition to the bus termination resistor R2 specified in the EIA-RS-485 Standard an additional resistor R1 (Pull-down) must be connected to the data reference potential DGND and a resistor R3 (Pull-up) connected to the supply voltage plus VP. These two resistors are used to define a specific idle potential on the bus when no participant is transmitting (idle time between telegrams, the so called idle-status).

Values see DIN 19245, Part 1 and Part 3.
For cable Type A: $R_1 = 390\ \Omega$, $R_2 = 220\ \Omega$, $R_3 = 390\ \Omega$
For cable Type B: $R_1 = 390\ \Omega$, $R_2 = 150\ \Omega$, $R_3 = 390\ \Omega$

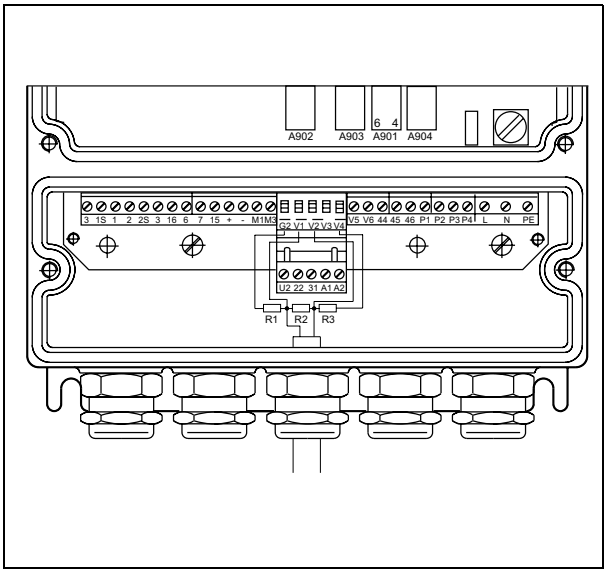


Fig.13 Bus Termination for Profibus DP, when the Instrument is Connected at the End of the Bus

GSD File (Instrument Data Base)

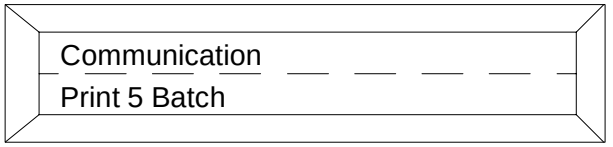
The name of the GSD file is ABB_6666.GSD and is included with the shipment. For a detailed description of the Data Link see the separate Document ABB Part No. D184B093U03.

Communication Protocols

Print 5 Batch

It is possible to select one of two printer protocols and to initiate a print out over the serial data link from a pulse applied to the contact input function “External Totalizer Reset”.

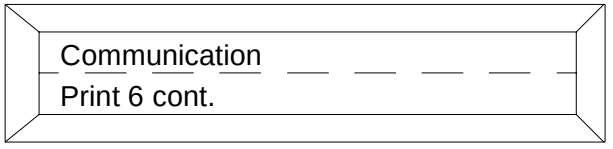
The data and time can also be printed when using the ABB-Printer (55DE1000). The time can be set in the Printer Clock parameter.



A printer output is initiated when the flowrate drops below the low flow cutoff value after a pulse is applied to the external totalizer reset. The date and the time (requires the 55DE1000), the instrument number, the forward totalizer value, the forward overflow counter value, the reverse totalizer value and the reverse overflow counter value are printed.

The foward and reverse totalizers are then cleared.

Print 6 Continuous



A printer output is initiated when a pulse is applied to the external totalizer reset input. The date and the time (requires a 55DE1000), the instrument number, the forward totalizer value, the forward overflow counter value, the reverse totalizer value, the reverse overflow counter value and the instantaneous flowrate value in percent or engineering units (based on the selection in display) are printed.

Printer “55DE1000” Output

An example of the printer outputs for both printer protocols:

Print 5 Batch	**Print 6 cont.**	
**********	**********	
18.07.1997 14:05:23	18.07.1997 14:05:56	Date, time only with ABB Printer 55DE1000
*No.: 1 *	*No.: 0 *	Instrument number
* →F 349.310 l *	* →F 233.456 l *	Forward totalizer
*Overflow →F 1 *	*Overflow →F 2 *	Forward overflow counter
*← R 1140.10 l *	*← R 3.45600 l *	Reverse totalizer
*Overflow ← R 0 *	*Overflow ← R 0 *	Reverse overflow counter
	* →F 149.800 l/min *	Actual flowrate
**********	**********	

Printer Type

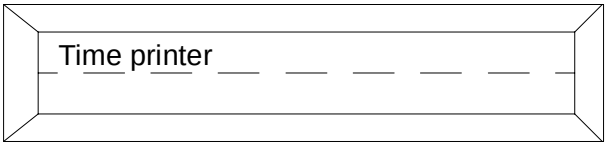
Entry from Table

A selection between a standard printer (Standard) and the ABB Printer 55DE1000 can be made in this parameter. The baudrates of the printer and the data link must be adjusted so they are compatible.

An incorrect character set is processed if an incorrect printer type is selected resulting in an improperly printed report.

When any standard printer is connected to the converter data link (minimum printer specifications: 40 characters/line, printer buffer 1kByte, ASCII character set compatible), then the printer type “Standard” should be selected.

Time Printer



In conjunction with the ABB 55DE1000 Report Printer, the date and the present time can be printed on all the printer reports. The printer must include a clock module. The year, month, day, hour and minutes can be entered as 2 place numbers.

5.5.2 HART®-Protocol

The HART-Protocol provides for simulataneous process value display and digital communication without requiring any additional installation. The analog 4-20 mA current output signal transmits the process values while also providing for bidirectional communication. The analog output process value can be utilized by analog indicators, recorders and controllers while the HART-Protocol provides for simulataneous digital communication.

The HART-Protocol operates on the Frequency-Shift-Keyed (FSK) principle based on the Bell 202 Communication Standard. The digital signal is composed of the two frequencies 1200 Hz and 2200 Hz which represent the bit values1 and 0 respectively.

This design requires the appropriate HART software and a 4-20 mA current output selection.
Terminals +/- with a load of at least 250 Ω.

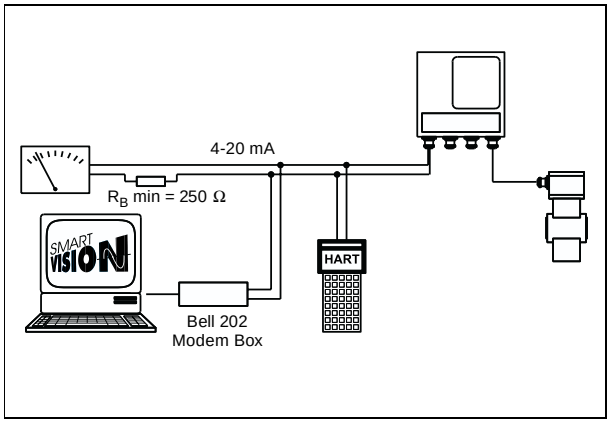


Fig.14 Communication with the HART-Protocol

For connection to a PC, a FSK-Modem must be installed for HART communications. The HART-Modem converts the analog 4–20 mA current signal into a digital output signal per Bell 202 with a RS 232C output to the PC.

In addition, the MAG-SM can also be accessed and configured from a handheld terminal Type 275. A parallel connection is made to the 4–20 mA current output. Please refer to the appropriate Hand Held Terminal Instruction Bulletin.

When a mutliplexer is installed and the ABB software package Smart Vision is utilized all field instrument in the control room can be centrally configured, monitored and their data values read for establishing balances using the HART-Protocol. The Smart Vision Program includes, in addition to its configuration and display features, a cyclical self monitoring feature for all the connected field instruments.
Field Multiplexer Model: 55HX1000. See Fig. 16.

Electromagnetic Flowmeter Converter

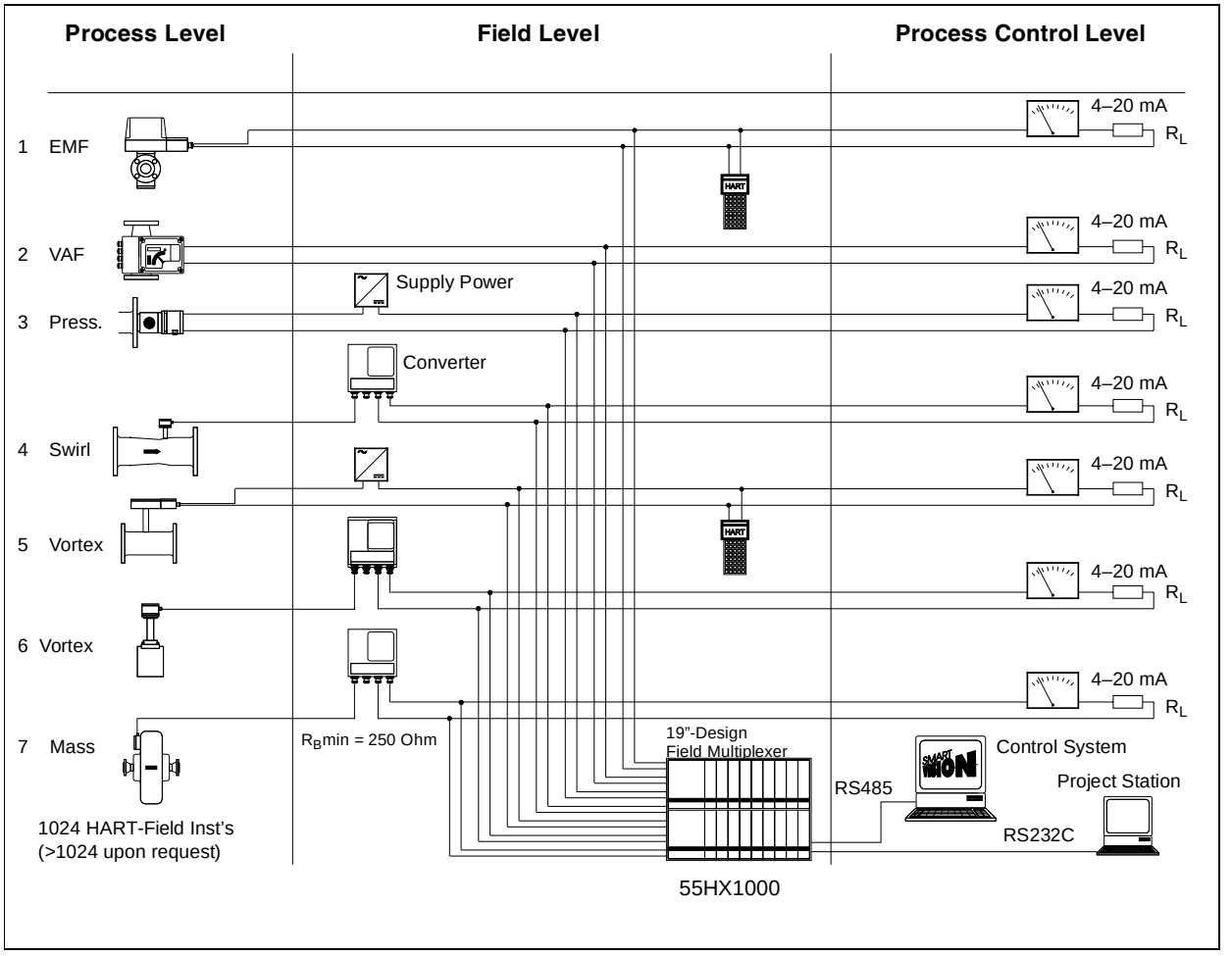
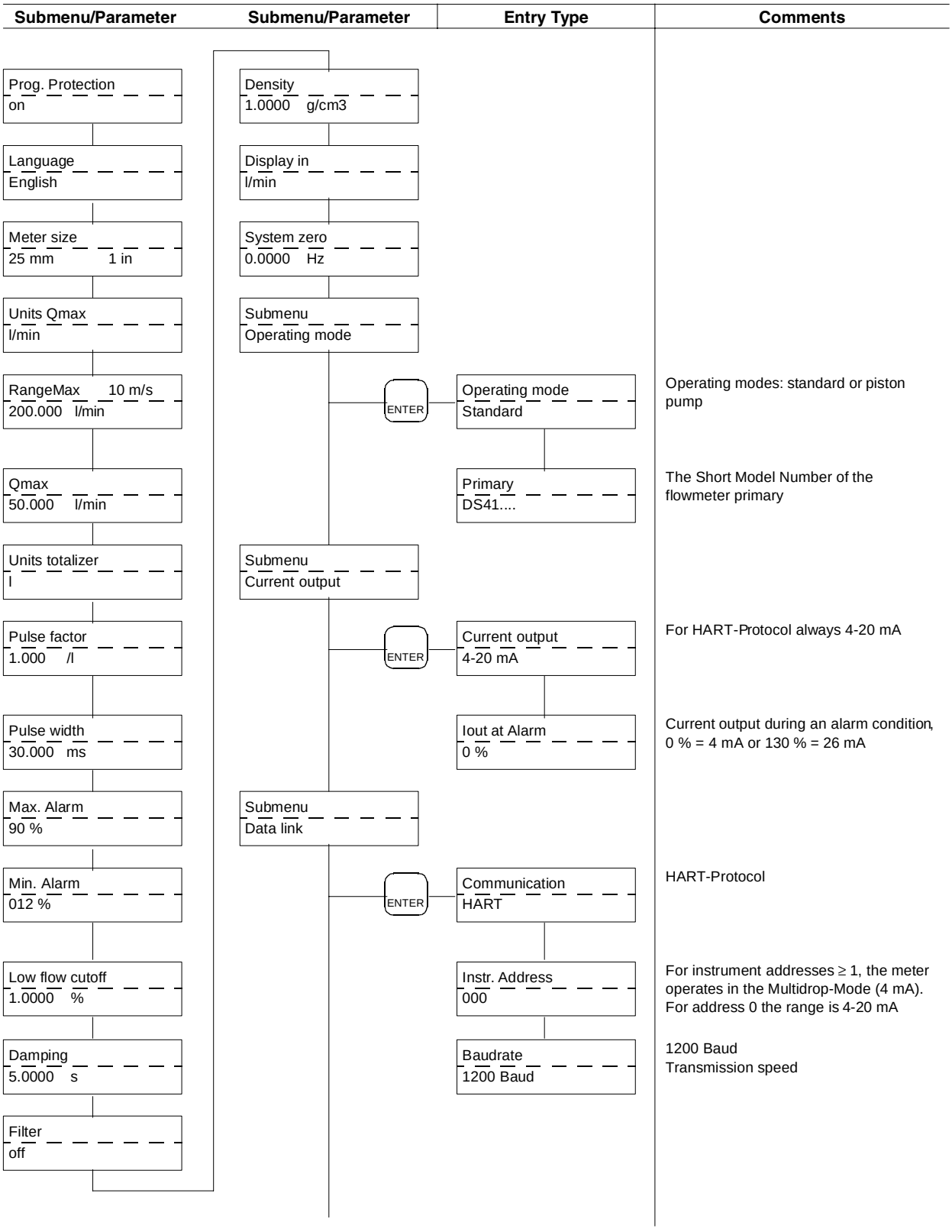
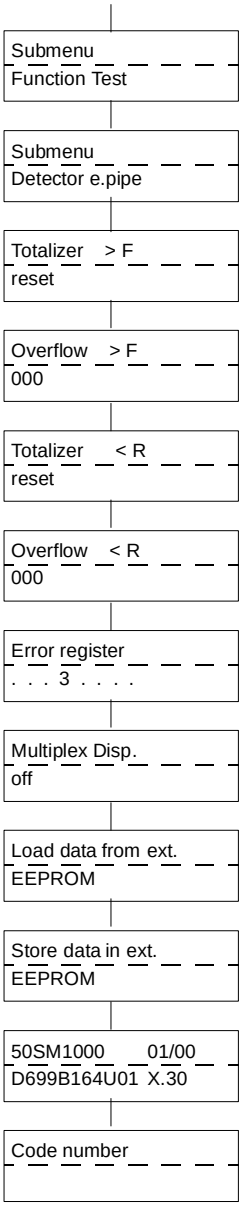


Fig.15 Communication with a PCS using a Field Multiplexer or a PC with Smart Vision Software

5.5.3 Parameter Overview HART-Protocol, Data Entry, see Pages 19 to 26



Submenu/Parameter	Entry Type	Comments
		

6. Maintenance

6.1 General

WARNING:
The are electrostatic sensitive parts on the circuit boards (observe EGB-Guidelines)

6.2 Testing the Converter with the Flowmeter Primary Simulator 55XC4000

The test procedure is described in the Flowmeter Primary Simulator Instruction Bulletin. Part No. D184B049U01. Only trained personnel should conduct the tests.

6.2.1 Maintenance

The converter is maintenance free.

Note:

Please observe the “Introductory Safety Notes for the EMF System” if a converter must be returned to the factory for repairs.

Service Note:

For replacement or repair, only original replacement parts should be used.

6.3 Error Messages and Checks

6.3.1 Error Messages by Priority

Error No.	Clear Text	Cause	Corrective Measures
4	EXT.ZERO RETURN	Ext. zero return contact active	Open contact between terminals U22/22 or G2/22.
5	EEPROM DEFEcT NVRAM loaded	Data in EEPROM corrupted	Install replacement converter, check defective converter (see Test Converter), readjust or return to factory.
0	EMPTY PIPE	Pipeline not full	Fill pipeline.
2	REF TOO SMALL	Pos. or neg. reference too small	Check installation (signal cable). Set switch S901 correctly. Measure reference voltage at converter (3 to 16 or 6 to 7).
7	REFp TOO LARGE	Positive reference too large	Select the correct flowmeter primary type in converter. See Page 19 check installation.
8	REFn TOO LARGE	Negative reference too large	
1	A/D SATURATED	A/D-Converter saturated	Check ground (flowmeter primary). Check signal cable.
3	FLOWRATE > 130 %	Flowrate greater 130 %	Increase flow range. (Q_{max}).

In the list below Error Codes shown in the display are described. (These Error Codes occur only during data entry).

Error Code	Cause
10 11	Entry >1.00 $Range_{max}$ (>10 m/s) Entry <0.05 $Range_{max}$ (<0.5 m/s)
13 16 17	$Range_{max} \leq 0$ Entry >10 %Low flow cutoff Entry <0 % Low flow cutoff
20 21	Entry ≥ 100 sec. Damping Entry <0.1 sec. Damping
22	Entry >99 Instrument address
38 39	Entry >1000 Pulses/Units Entry ≤ 0.001 Pulses/Units
40	Maximum frequency scaled pulse output >10 kHz
42 43	Entry >2000 ms Pulse width Entry <0.032 ms Pulse width
44 45	Entry >5.0 g/cm^3 Density Entry <0.01 g/cm^3 Density
54	System zero >1500 Hz
74	Entry >130 % Max. Alarm
76	Entry <130 % Min. Alarm

6.3.2 Testing the Metering System

WARNING:
Contact hazards exist when the housing cover is removed and the power is turned on !
These tasks should only be performed by trained personnel.

Does the supply power agree with the values listed on the converter Instrument Tag?	No	Solder correct jumpers for the required voltage, see Fig.20.
Yes		
Are the converter and the flowmeter primary installed in the proper locations ? (Flowmeter primary, Protection Class, converter, temperature, vibration, cable length, cable type, display indication in the correct flow direction)	No	Check allowable installation conditions, temperature (insulate high temperature design flowmeter primary and pipeline), Protection Class, vibration.
Yes		
Does the wiring agree with the specifications in the Interconnection Diagrams ?	No	Check the connections per the Interconnection Diagrams beginning on Page 7.
Yes		
Is the flowmeter primary correctly grounded?	No	Check the grounds per the Interconnection Diagram, also see the Flowmeter Primary Instruction Bulletin.
Yes		
Is the supply voltage value at terminals L & N within the nominal voltage limits of +10/-10 % ?.	No	Provide supply voltage within the limits.
Yes		
Is the flowmeter primary filled with fluid?	No	Fill pipeline.
Yes		
Is switch S901 on the connection board correctly set for the flowmeter primary type and size?	No	See Figs.18-20. Switch S901 is open for use with flowmeter primaries 10DS2110/3110. Switch S901 closed for use with flowmeter primaries 10DI1425 ≥ 20" [DN 500], 10DS3111A/ ..B/..C ≥ 20" [DN 500] and 10D1422 1/8"- 40" [DN3 to 1000].
Yes		
Turn on the power. Does the display indicate 0 % ? Is the correct flow direction indication → F for forward, ← R for reverse displayed in the 1st line ?	No	Adjust system zero according to instructions in 3.2. Check if the flow direction indicators agree with the flow direction[1]. Fuse defective ? Conductivity too low ? To check see Flowmeter Primary Instruction Bulletin.
Yes		
For continuous flow has the Standard operating mode been selected ? For pulsating flows has the Piston Pump operating mode been selected?	No	Select the parameter Standard or Piston Pump in the operating mode submenu. Turn on software filter, set damping >2.4 sec.
Yes		
Have the meter size, engineering units, flow range, density, pulse factor etc. been entered?	No	Enter meter size, units and flow range, select current output e.g. 0-20/4-20 mA.
Yes		
Does the present flowrate value agree with the displayed value and the output signals?	No	If the flow indication and current output are noisy a software filter can be turned on or the damping setting increased. Conduct Function Test 5.4 or check converter with Flowmeter Primary Simulator 6.2 .
Yes		
The metering system is operational. Store the meter location parameters in the external EEPROM. The meter location parameters can also be recorded on the page 52 in the Overview Page for future reference.		

1) If the flow direction does not agree with the flow direction indicators in the display, then the flow direction indicators are to be reversed. Select the "Flow Direction" parameter in the "Operating Mode" submenu" and change accordingly.

7. Block Diagram

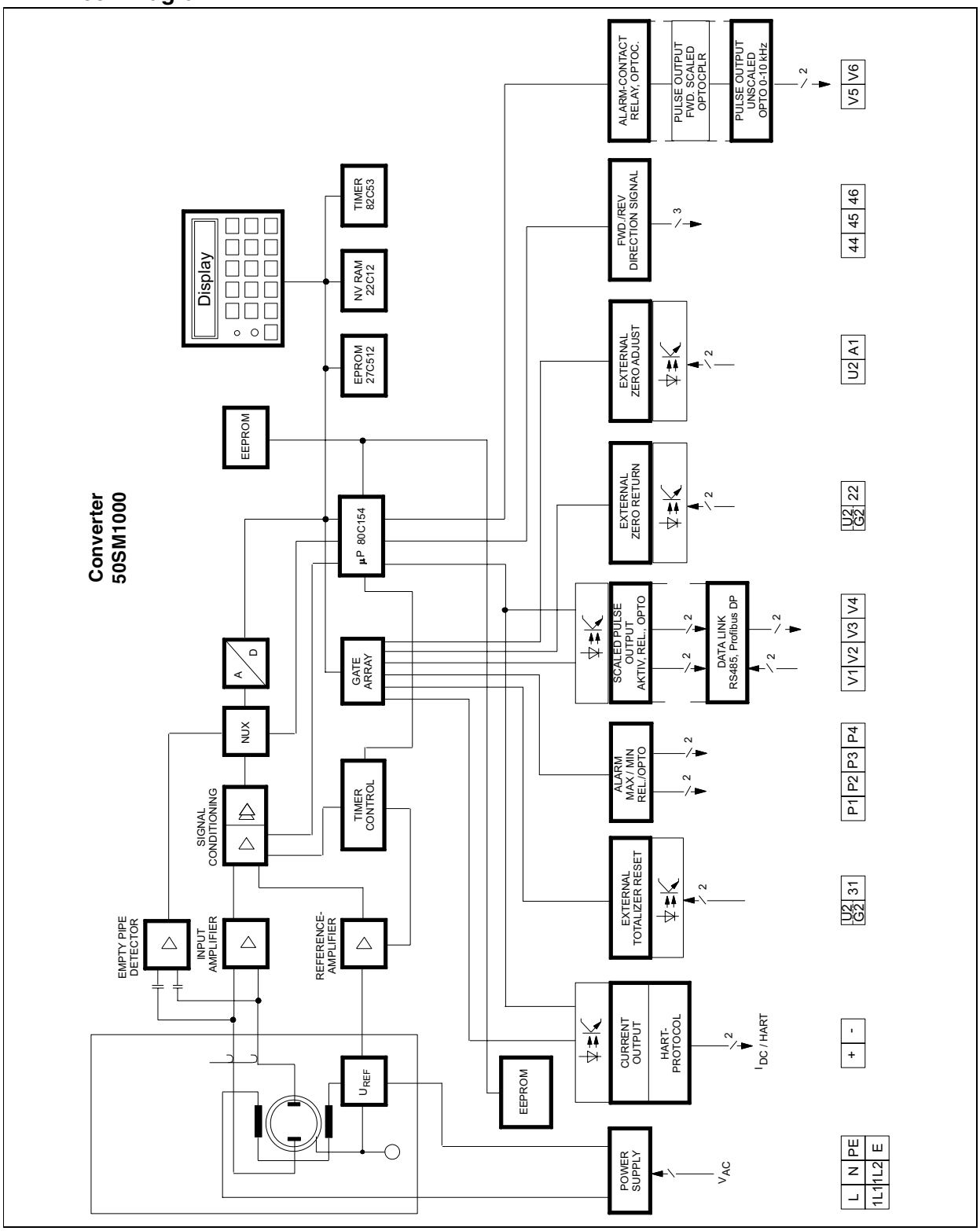


Fig.16 Block Diagram

7.1 Connection Board, Field Mount Housing 50SM1000

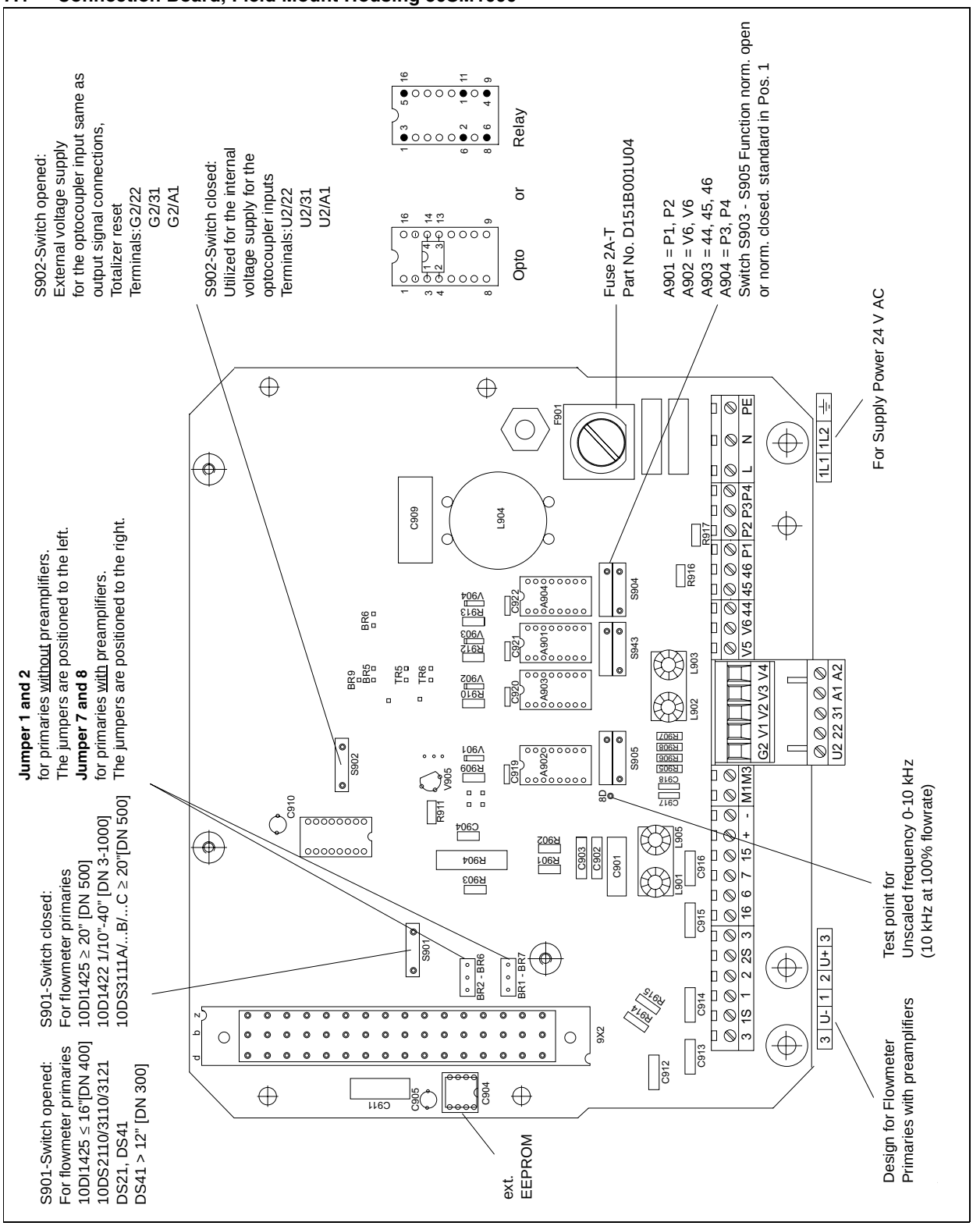


Fig.17 Connection Board, Field Mount Housing

7.2 Connection Board 19”-Design 50SM1000

Terminal designations for flow-meter primaries with preamplifiers
U-, 1, 2, U+

S901-Switch opened:
For flowmeter primaries
10DI1425 ≤ 16”[DN 400}
10DS2111/3111/3121
10DS2112/3112

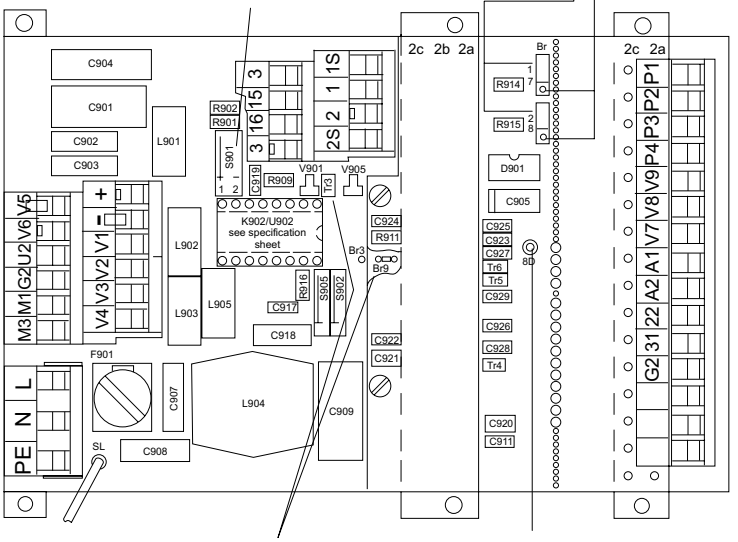
S901-Switch closed:
For flowmeter primaries
10DI1425 ≥ 20”[DN 500]
10D1422 1/10”-40”[DN3-1000]
10DS3111A/...B/...C ≥ 20”[DN] 500

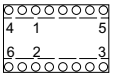
Jumper 1 + 2 for flowmeter primaries without preamplifiers

Jumper 7 + 8 for flowmeter primaries with preamplifiers

Standard and Ex-Design
Model 10DS3111
Terminals M1/M3

Ex-Design
Model 10DS3112
Terminals F1/F3



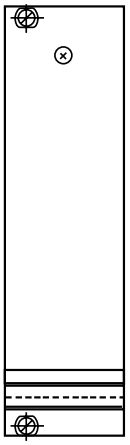


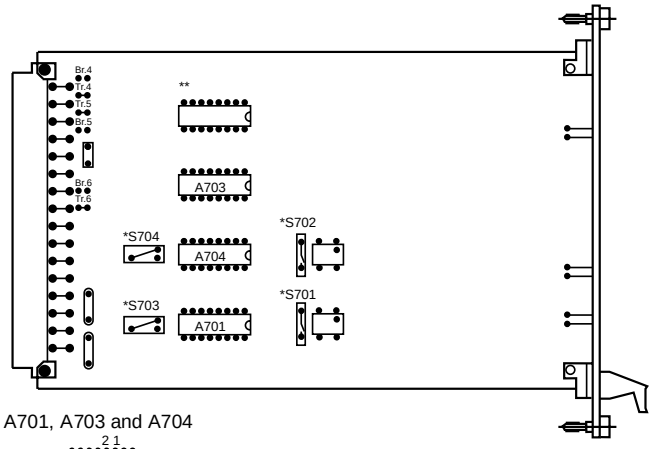
Relay design

L/N/PE 100/110/120/240 V AC
1L1/1L2/PE 24 V AC

For forward pulse 0-10 kHz
Circuit board trace break Tr.3
Jumper Br.9

Test point for operating frequency 0-10 kHz
(10 kHz at 100 % flowrate)





A701, A703 and A704

Opto

or

Relay

* Switch S701, S702 standard opened
* Switch S703, S704 Position 1 contact output P1 - P4 normally open
Position 2 contact output P1 - P4 normally closed

** Inputs: Ext. zero return,
Ext. totalizer reset,
A1, A2
A703: forward/reverse direction signal
A704: P3/P4 alarm MIN.
A701: P1/P2 alarm MAX.

Fig.18 19”-Connection Board Relays

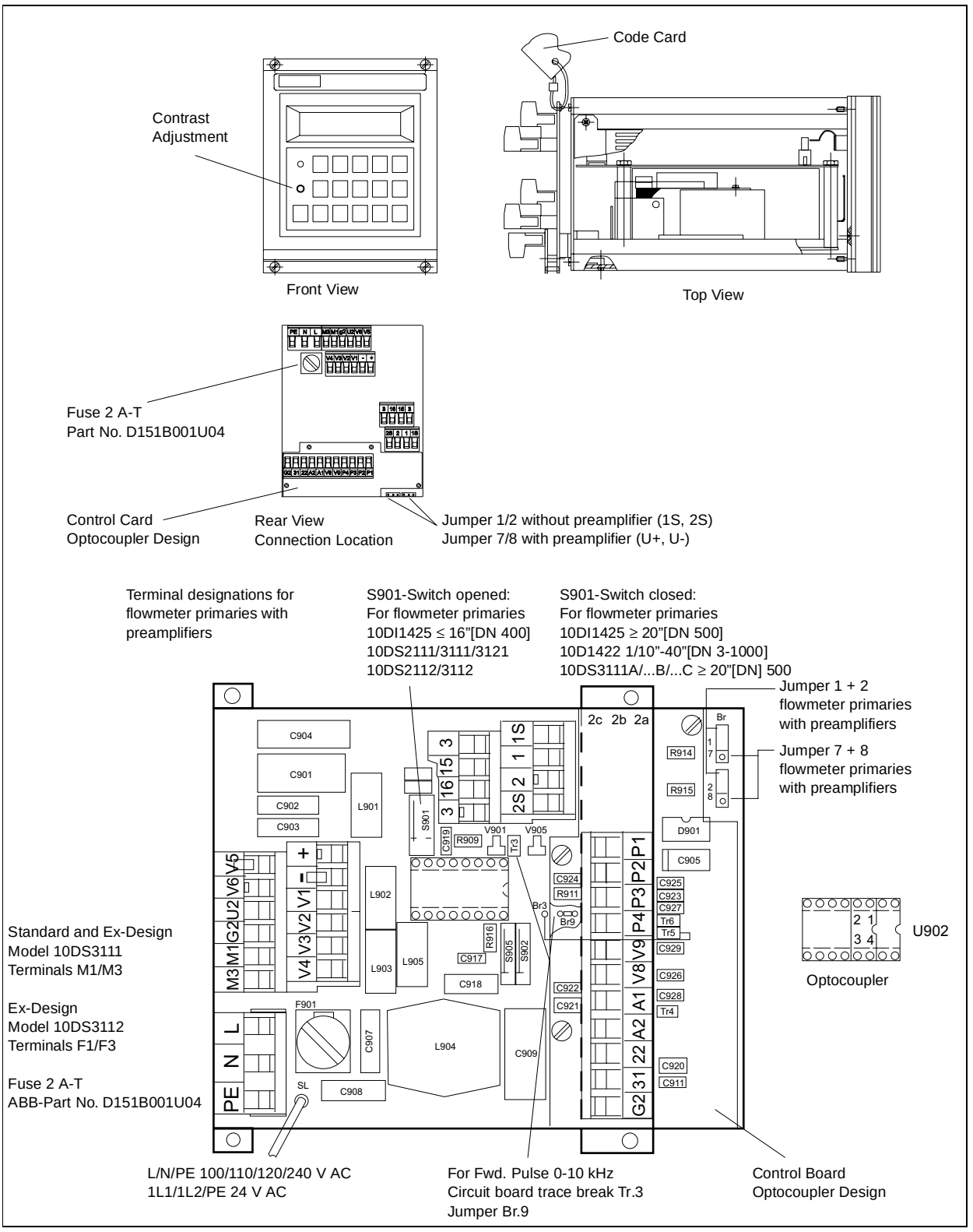
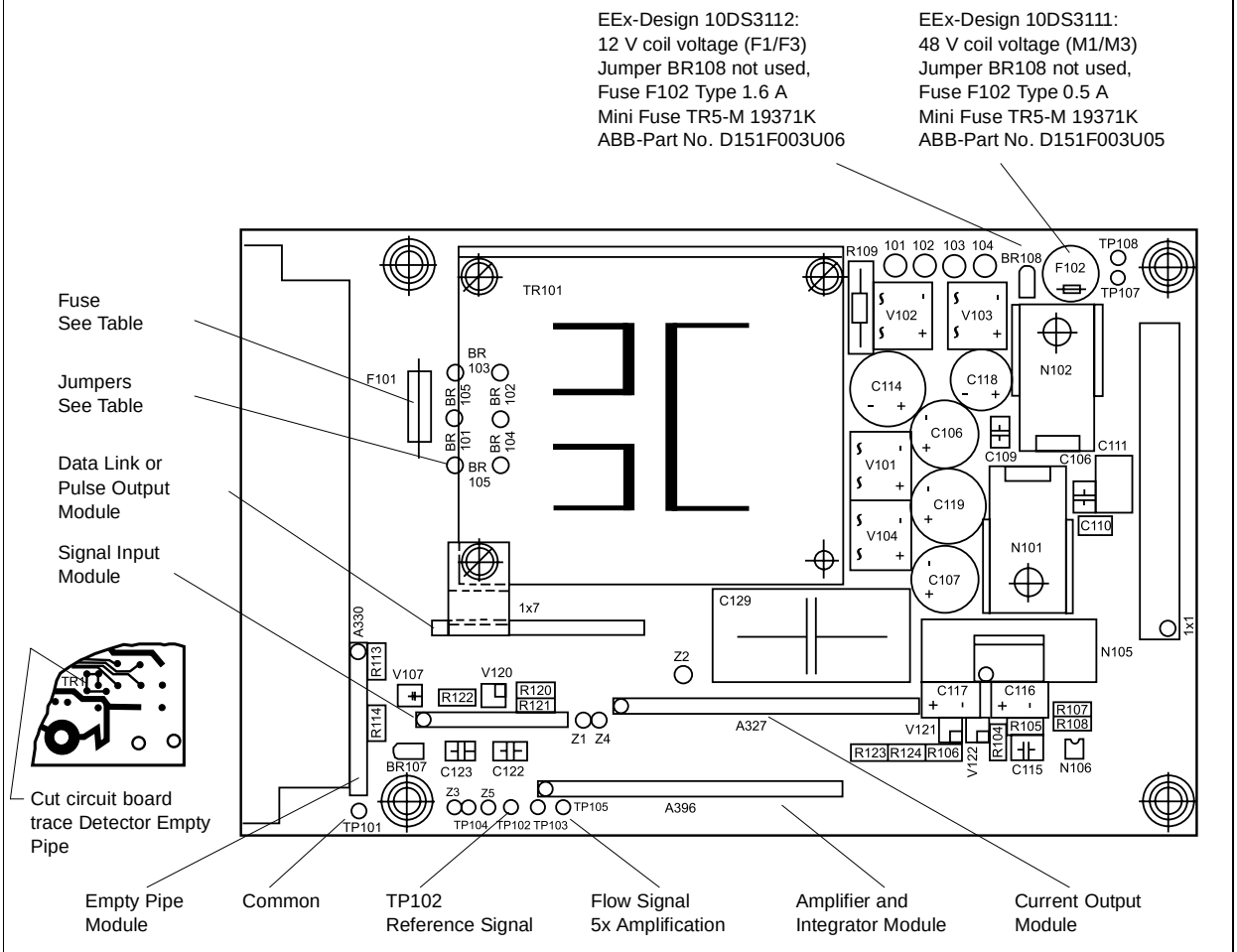


Fig.19 19"-Connection Board Optocoupler

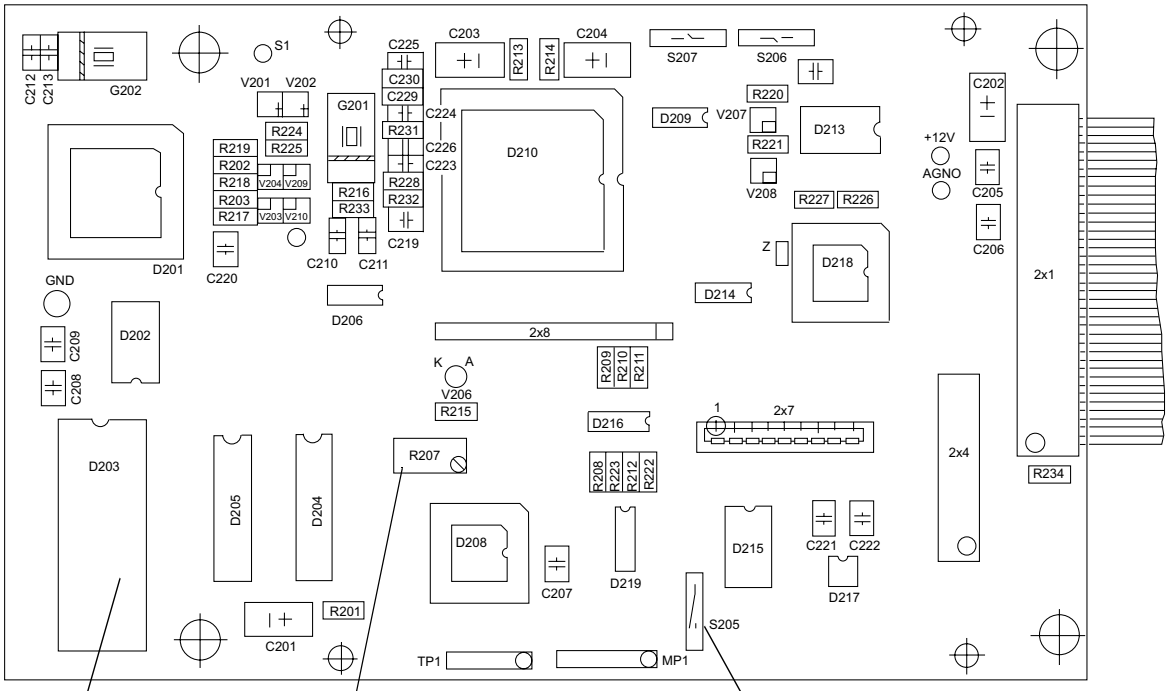
7.3 Analog Board MAG-SM



AC	Br. 101	Br. 102	Br. 103	Br. 104	Br. 105	Br. 106	F101	Fuse ABB Replacement Number
240 V	X						0.160 A-T	D151B001U09
220 V		X					0.160 A-T	D151B001U09
120 V					X	X	0.315 A-T	D151B001U01
110 V			X	X			0.315 A-T	D151B001U01
For the voltage listed below a different transformer type is used for TR 101 for the Standard and Ex-Flowmeter Primaries.								
24 V					X	X	0.8 A-T	D151B001U18

Fig.20 Analog Board MAG-SM

7.4 Digital Board MAG-SM



Standard EEPROM
Part No. D699B154U01

HART-Protocol
Part No. D699B164U01

Display Contrast Setting
Field Mount Housing

S205 open 19”-Insert
S205 closed Field Mount Housing

Fig.21 Digital Board MAG-SM

7.5 Assembled Module

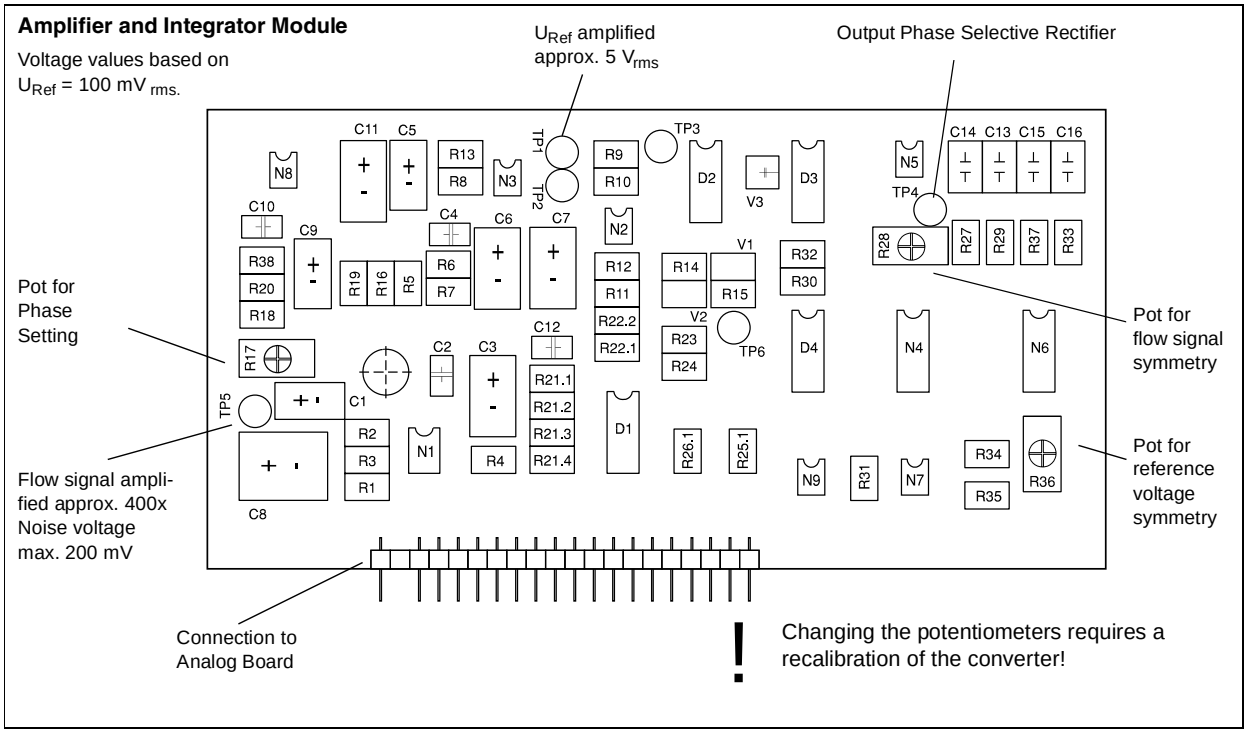


Fig.22 Amplifier and Integrator Module

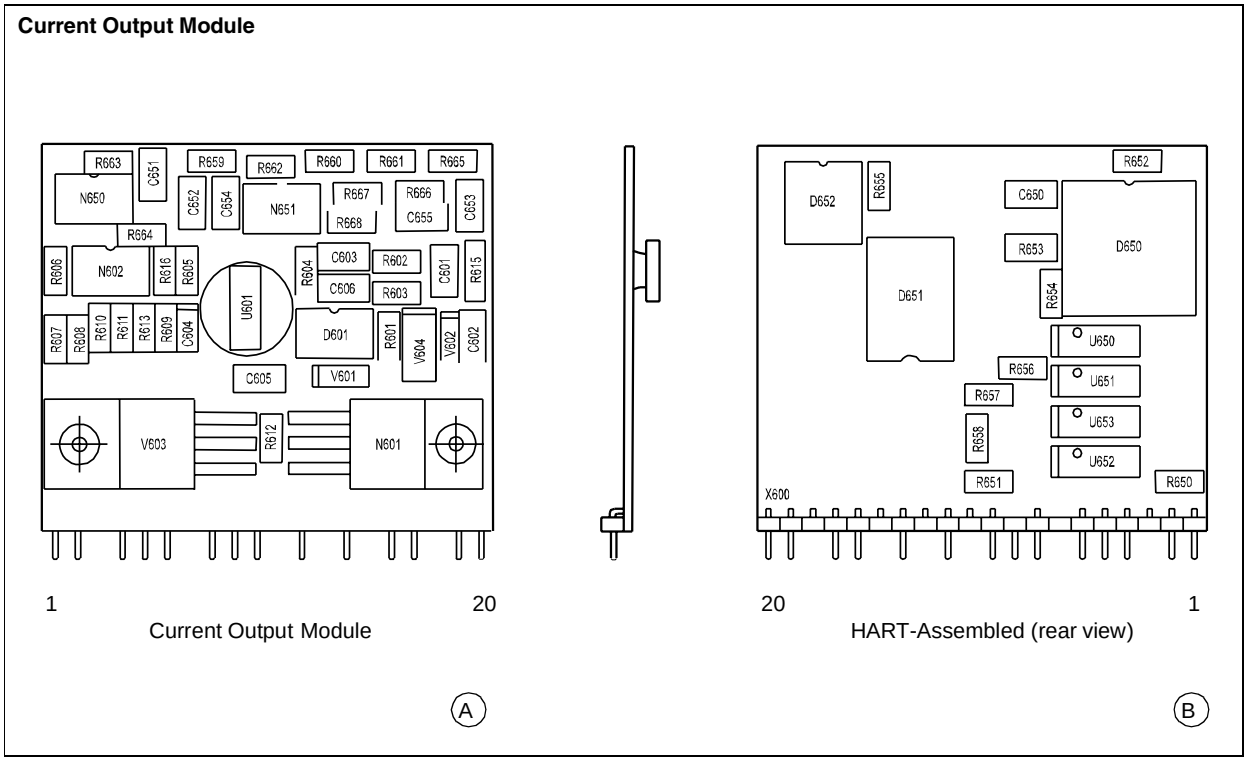


Fig.23 Current Output Module + HART-Assembled (Option)

Detector Empty Pipe Module

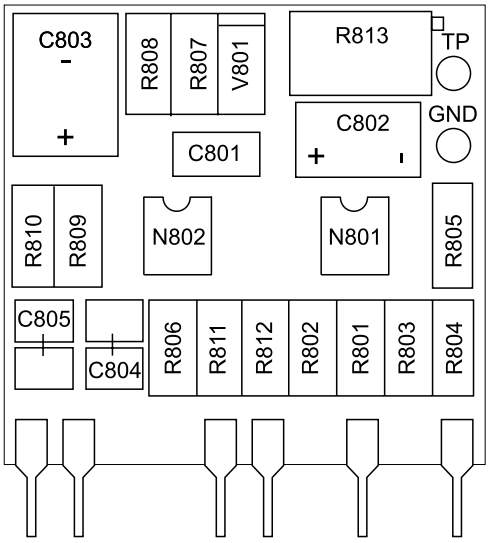
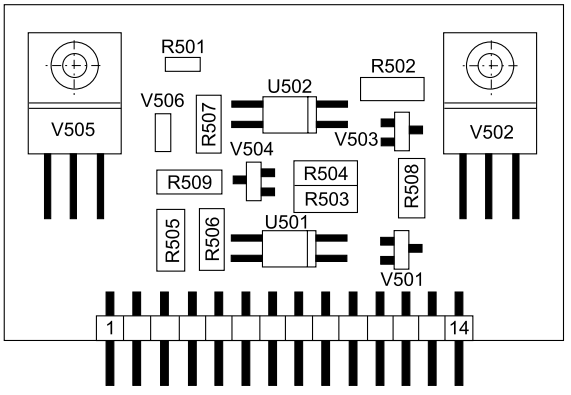


Fig.24 Empty Pipe Module (Option)

Pulse Amplifier Module with Active Output



Pulse Amplifier Module with Relay Output

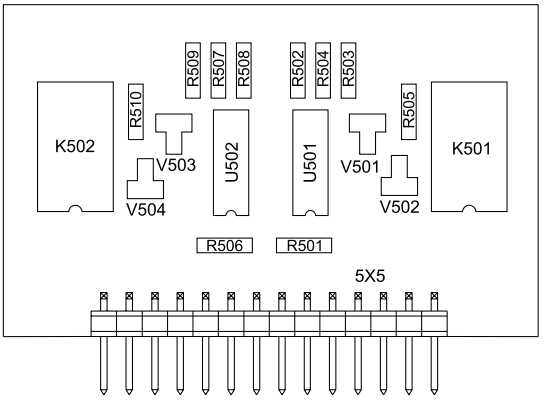
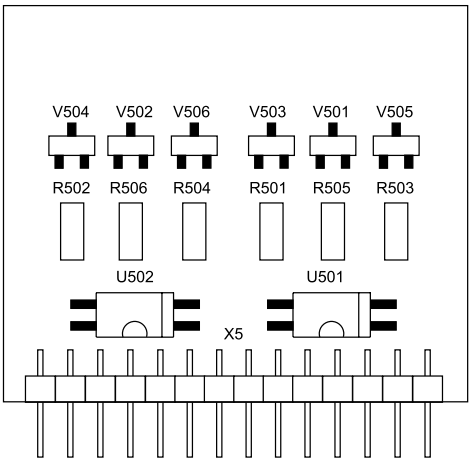


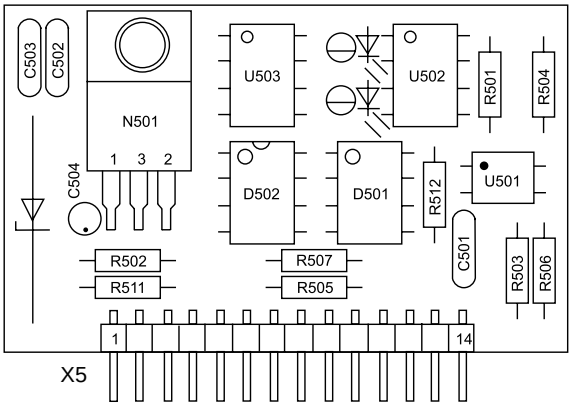
Fig.25 Pulse Output Module Active or Relay

Pulse Amplifier Module with Optocoupler Output



F

Serial Data Link RS 485 (RS 422)



H

Fig.26 Pulse Output Module Optocoupler, Data Link RS 485

Electromagnetic Flowmeter Converter

8. Replaceable Parts List, Converter 50SM1000 Field Mount Housing

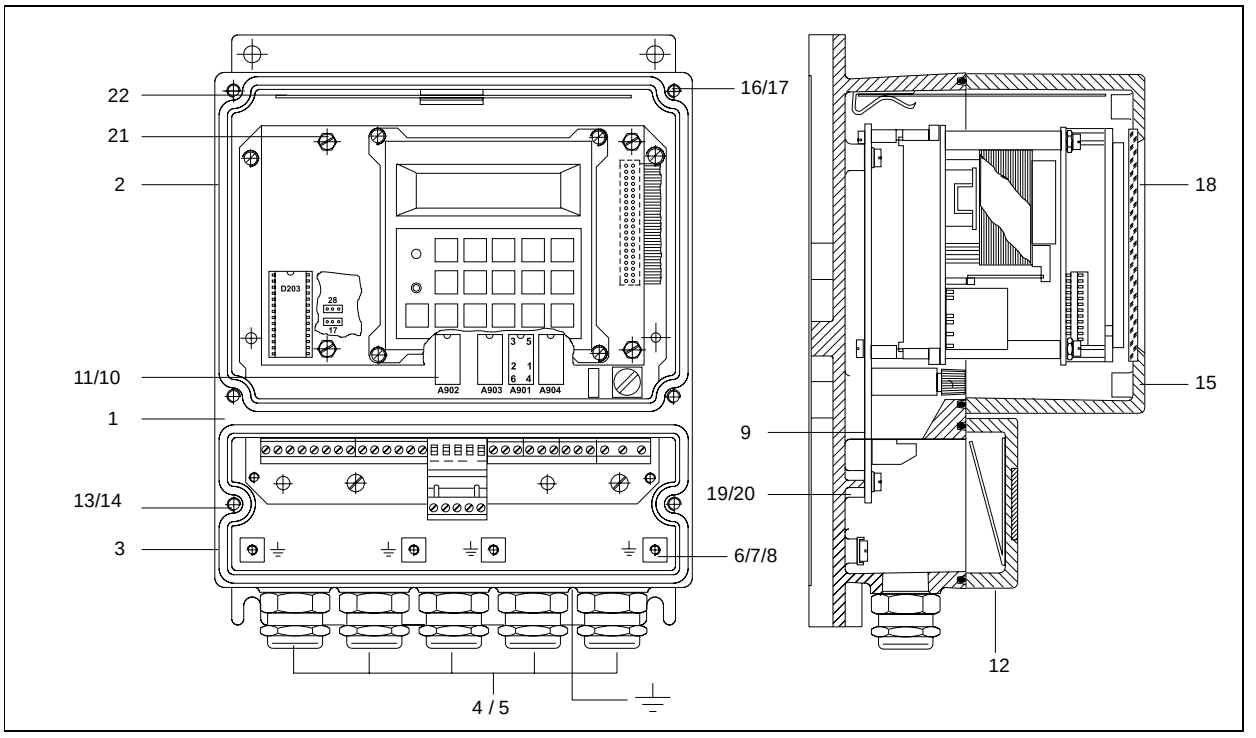


Fig.27

No.	Description	Part No.
1	Housing - lower section	D612A109U16
2	Gasket	D333F011U01
3	Gasket	D333F013U01
4	Seal plug	D114A001U13
5	Cable connector M20 x 1.5	D150A008U15
6	Clamp bracket	D108A003U02
7	Slotted pan head screw M4x10 DIN 84	D002G108AU30
8	Spring washer B 4.0 DIN 127	D085C020BU05
9	Connection board	D685A583U02
10	Relay design	D163B013U01
11	Optocoupler design	D177B009U17
12	Housing cover	D641A019U01
13	Slotted hex head screw M6x25 DIN 7964	D024J116AU20
14	Spring washer B 6.0 DIN 127	D085C026BU20
15	Housing cover with window, hinged	D614A018U03
16	Slotted hex head screw M6x14	D396A012U04
17	Spring washer B 6.0 DIN 127	D085C026BU20
18	Safety glass window pane	D332A015U01
19	Slotted pan head screw M4x8 DIN 84	D002G107AU30
20	Spring washer A 4.0 DIN 137	D085D020AU05
21	Cylinder head screw M4x60 (4x)	D396A011U01
22	Code card	D120B009U01
A	Current output module	D685A473U04
B	Current output module with HART-Protocol	D685A473U05
C	Detector empty pipe module	D685A330U01
D	Pulse amplifier module with active output	D685A431U02
E	Pulse amplifier module with relay output	D685A712U02
F	Pulse amplifier module with optocoupler output	D685A606U02
H	Serial data link RS 485 (RS 422)	D685A299U01

8.1 Replaceable Parts List, Converter 50SM1000 19”-Design

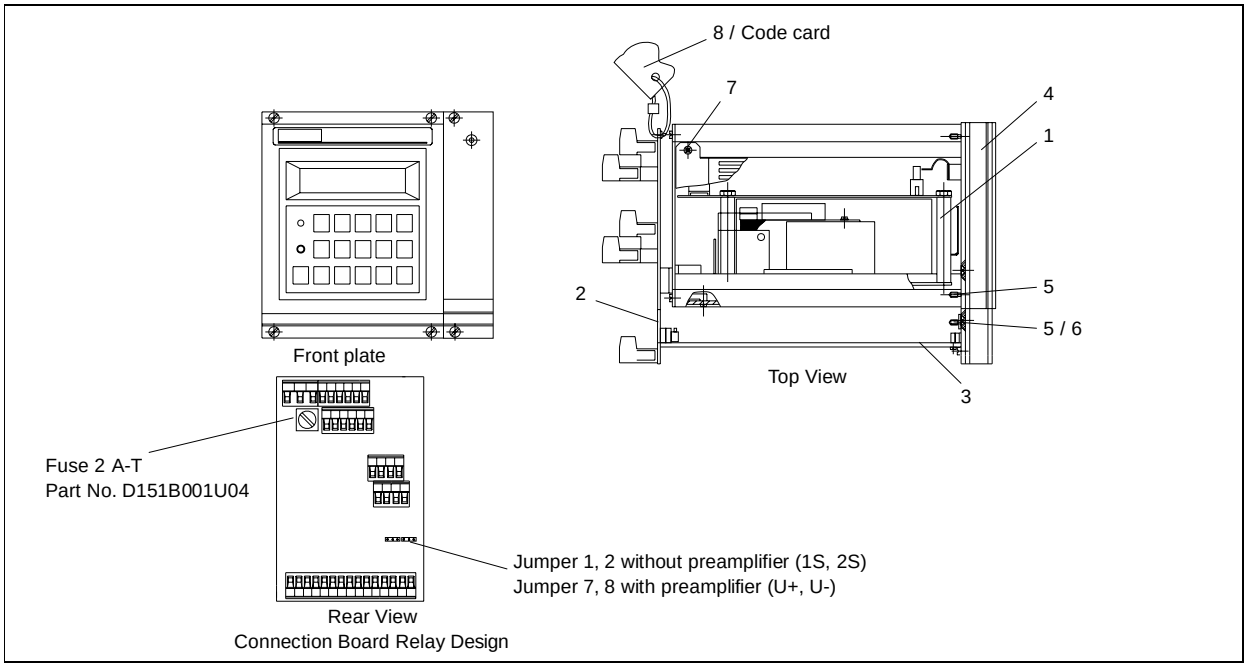


Fig.28

No.	Description	Part No.
1	19” Insert Converter Standard	
	230 V AC	D674A331U10
	115/120 V AC	D674A331U19
	48 V AC	D674A331U37
	24 V AC	D674A331U46
2	Connection board relay	D685A494U02
	Connection board optocoupler	D685A494U03
3	Control card (only for relay design)	D685A434U02
4	Front plate with display (no Logo)	D626A002U08
5	Shoulder screw 2.5x11	D124E012U02
6	Plastic nipple	D124E012U03
7	Phillips flat head screw M2.4x4 DIN 965	D006E104AU20
8	Code card	D120B009U01
A	Current output module	D685A473U04
B	Current output module with HART-Protocol	D685A473U05
C	Detector empty pipe module	D685A330U01
D	Pulse amplifier module with active output	D685A431U02
E	Pulse amplifier module with relay output	D685A712U02
F	Pulse amplifier module with optocoupler output	D685A606U02
H	Serial data link RS 485 (RS 422)	D685A299U01

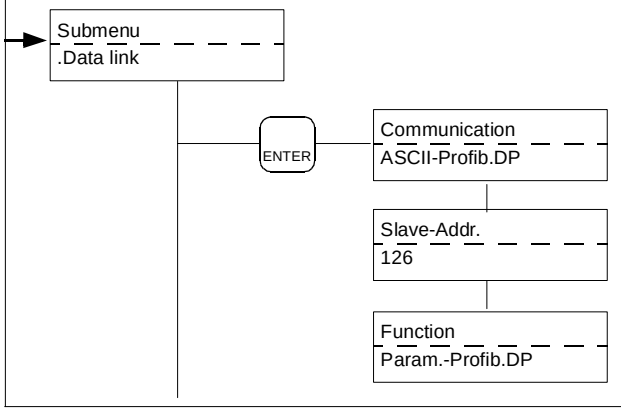
9. Safety Information per EN 61010-1

- The installation and operation fo the instruments must be in accord with the Instruction Bulletin. Deviations therefrom could impact the safe operation of the instrument.
- Test specifications for the supply power:
  see Instrument Tag or Specification Sheet.
- The cables for the supply power are in accord with the applicable National and International standards. Each instrument requires its own separate fuse which should be installed close to the instrument and appropriately identified.
- Protection Class I.
- Overvoltage Category II (IEC 664).
- The instruments are maintenance free.
- Installation and maintenance tasks are only to be performed by trained personnel.
- There are circuits inside the housing which are hazardous to personnel contact. Therefore the supply power should be turned off before opening the housing.
- For overhaul or repair only original replacement parts obtained from ABB are to be used.
- The voltage supply and the circuits for the excitation coils in the flowmeter primary and hazardous to personnel contact.
- The excitation and signal circuits can only be connected to the appropriate ABB flowmeter primaries. The excitation supply cable between the converter and the flowmeter primary is to be sized, as a function of the design type, for a nominal voltage of 60 V AC or for the line voltage for external voltage supplies. For the flow signal the cable included with the shipment D173D018U02 is to be used.

9.1 Additional Information for Profibus DP

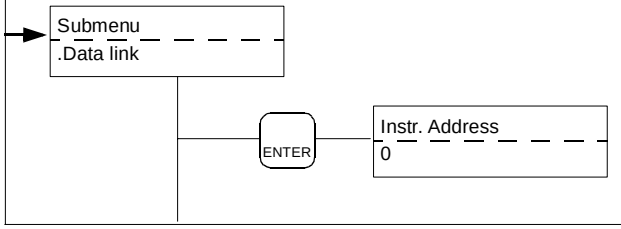
GSD File (Instrument Data Base File)

The name of the GSD file is FP6666.GSD and is included with the shipment.

Parameter Entry		
		The communication mode Profibus DP is selected in the Submenu Data Link. The Slave-Address must always have 3 digits, Address-Range 000, 001 to 126. If a one or two digit bus address is entered, an incorrect interpretation of the bus address will be made by the converter. This function can be used to access the parameters in the Profibus DP-Module. See also Section 13 „Data Link Functions” Part No.D184B093U02.

9.2 Additional Information for Connecting to HART-Protocol®

The converter Instrument Tag includes the term HART-Protocol. The appropriate software can be recognized by the label attached to the EPROM with the identification, e.g. D699B164U01 X.30,abbreviated as B164U01 X.30.
There are a number of parameter functions pre-installed in this software. The current output is set to 4-20 mA, the min. load is 250 Ohm. Not all standard settings are available in HART. Please observe the note in Section 5.5.3 Parameter Overview HART-Protocol, Data Entry, see Pages 19 to 26 .

Parameter Entry		
		The instrument address can be set between 0 and 15. If the Address is set to 0, then the current output value for the flowrate is changed to the range from 4.00 to 20.00 mA. If additional instruments are connected to the bus and an Address 1-15 is set, then the converter operates in the Multidrop-Mode. The current output is then set to a fixed 4.00 mA value. The evaluation of the measurement values is only possible using the HART-Communication.

9.3 Additional Information for the Pulse Output

The scaled pulse output can be ordered as a 2-channel pulse output, separate for forward and reverse in an active (24 V DC) or passive (optocoupler) design. When configuring the parameter the following settings must be entered.

Parameter Entry

Pulse factor
1.0000 / m3

Pulse width
230

Totalizer units
m3

Pulse Factor
The pulse factor is the number of output pulses for one measured flowrate unit. When the pulse factor is changed, the totalizer value in the selected units remains unchanged. The pulse factor can be selected in the range from 0.001 to 1000 pulses/unit.
The selected pulse factor is checked by the converter as a function of the flow range, the pulse width, the volume (e.g. ml, l, m3) or mass (e.g. g, kg, t) units. If any one of these parameters is changed the pulse width may not exceed 50% of the period of the output frequency at 100% flowrate (on/off ratio 1:1). If the pulse width exceeds this limit it is automatically reduced to 50% of the period and the message **Warning! New pulse width** is displayed.

Pulse Width
The pulse width (length of the pulses) for the selected pulse output can be set between 0.1 and 2000ms. The pulse width must be sufficiently short so that at a maximum output frequency (flowrate max. 100% = 5 kHz) there is no overlapping of the pulses. On the other hand, the pulse width must be long enough to assure that it can be measured by the connected instrumentation (SPC).
Example:
Flow range = 100 l/min (Qmax = 100 % flow range end value)
Totalizer = 1 pulse/l

$$f = \frac{100\,\text{pulses/min}}{60\,\text{s}} = 1.666\ \text{Hz}$$

To allow for a 30% over range

$$f = 1.666\ \text{Hz} \times 1.3 = 2.166\ \text{Hz (1/s)}$$

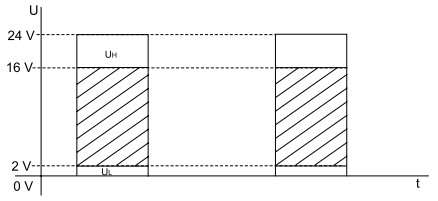
On/off ratio of 1:1 (pulse width = pause width)

$$t_p = \frac{1}{2{,}166\,\text{s}^{-1}} \times 0.5 = 230\ \text{ms}$$

Any value < 230 ms can be set. Counters usually require a pulse width ≥ 30 ms.
The converter automatically checks the pulse width setting. Its maximum value may be 80 % of the output frequency at 130 % flowrate. If this limit is exceeded, the new value will not be accepted and the message entry too large will be displayed.

Current and frequency specifications should be considered.

When connecting an active or passive counter the max. allowable current and frequency values must be considered.
Example:
A passive 24 V counter is connected:
The max. output frequency is 10 kHz.



Voltage
$0\ V \le U_L \le 2\ V$; $16\ V \le U_H \le 24\ V$
Current
$5\ mA \le I \le 30\ mA$

9.4 Additional Information for Piston Pump/Pulsation Operating

Parameter Entry		

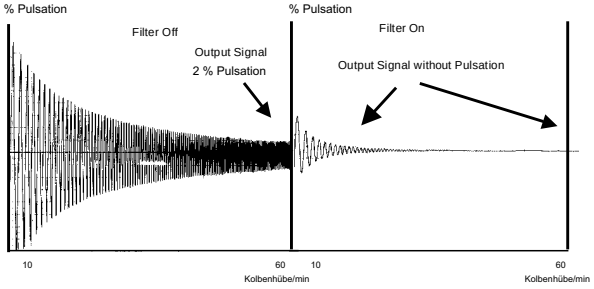
Submenu
Operating mode

Operating mode
Piston pump

Filter
on

Damping
5.0000 s

The primary applications for the AC field flowmeters is for fast measurement processing of continuous flows for single or multiphase fluids. If pulsation dampeners can be installed then the DC field flowmeters can usually be utilized. If the use of pulsation dampers is undesirable or impossible, then instruments with higher magnetic field excitation frequencies must be employed. For metering the pulsating flow after single stage piston, hose and diaphragm pumps the converter must be able to correctly process the peak flowrates. These peaks seldom reach more than three times the average flowrate. As long as the converter can linearly process these flowrate peaks and sufficient samples are measured, the accuracy for longer totalizer periods of the measurement system is unaffected. Therefore the parameter Piston Pump is to be selected in the Submenu Operating Mode. A digital filter is incorporated in the converter especially for pulsating flows or noisy signals. It smooths the instantaneous display indications and a noisy output current. The damping value can be reduced when the filter is turned on. The response time of the converter is not affected.
There is no relationship between the HART-Protocol and the filter and the damping.
The filter must be turned on and a damping value >2.4s should be set.



Electromagnetic Flowmeter Converter

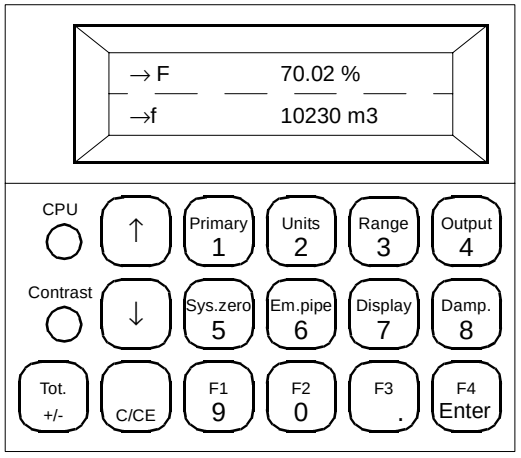
10. Parameter Setting Overview and Flowmeter Design Options

Meter Location:		TAG-No.:		
Primary Type:		Converter Type		
Order No.:	Instrument No.:	Order No.:	Instrument No.:	
Fluid Temp.:		Voltage Supply:	V	Hz
Liner:	Electrodes:	Excitation Frequency:		Hz
C:		System Zero:		

Parameter		**Setting Range**
Prog. Protection Code		0–255 (0 = factory setting)
Language		German, English, French, Finnish, Spanish, Italian, Dutch, Danish, Swedish
Flowmeter Primary:		10DS2110/3110, DS21, DS41, DS41 > 12"[DN 300], DH, 10DI1425 <20"[DN 500]; 10DI1425 >16"[DN 400], 10DS3111 E > 12"[DN 300] 10D1422, 10D1462/1472
Meter Size:		1/25" - 40" [DN 1 – 1000]
Q_{max}:		0.05 $Range_{max}$ to 1.5 $Range_{max}$
Pulse Factor:		0.01 to 1000 pulses/Eng'g unit
Pulse Width:		0.032 – 2000 ms
Low Flow Cutoff:		0 – 10 % of flow range end value
Damping:		0.125 – 99.99 seconds
Filter:		ON/OFF
Density:		0.01 g/cm^3 – 5.0 g/cm^3
Units Q_{max}:		l/s, l/min, l/g,hl/s, hl/min, hl/h, m3/s, m3/min, m3/h, igps, igpm,igph, mdg, gpm, gph, bbl/s, bbl/min, bbl/h, bls/day, bls/min, bls/h, kg/s, g/min, kg/h, t/s, t/min, t/h, g/s, g/min, g/h, ml/s, ml/min, ml/h, Ml/min, Ml/h, Ml/day, lb/s, lb/min, lb/h, uton/min, uton/h, uton/day, kgal/s, kgal/min, kgal/h
Totalizer Units:		l, hl, m3, igal, gal, mgal, bbl, bls, kg, t, g, ml, Ml, lb, uton, kgal
Max. Alarm		%
Min. Alarm		%
Terminals P1/P2:		Alarm MAX
Terminals P3/P4:		Alarm MIN
F/R-Contact 44/45/46		Forward/reverse flow direction signal
Current Output:		0/4–20 mA, 0/2–10 mA, 0–5 mA, 0–10–20 mA, 4–12–20 mA
I_{out} at Alarm:		0 %, 3.6 mA Max. I_{out} (100 %, 115 %, 130 %)
Detector e. Pipe:		ON/OFF
Alarm e. Pipe:		ON/OFF
I_{out} at e. Pipe:		0 %, 3.6 mA Max. I_{out} (100 %, 115 %, 130 %)
Threshold:		0–100
Adjust e. Pipe:		Software potentiometer value
1st Display Line:		Q (%), Q (units), Q (mA), Q (m/s), totalizer F/R, difference totalizer, TAG-Number, bargraph
2nd Display Line:		Q (%), Q (units), Q (mA), Q (m/s), totalizer F/R, difference totalizer, TAG-Number, blank line, bargraph
1st Line Multiplex:		ON/OFF
2nd Line Multiplex:		ON/OFF
Operating Mode:		Standard/piston pump
Flow Direction:		Forward/reverse, forward
Direction Indication:		Normal, Inverse
Store data in ext. EEPROM		Yes/No

Pulse output:	❑ Active	❑ Passive	
Communication:	❑ HART-Protocol	❑ RS 485	❑ Profibus DP
Detector empty pipe:	❑ Yes	❑ No	
Alarm:	❑ Yes	❑ No	
Ext. zero return:	❑ Yes Ext. totalizer reset	❑ Yes Ext. zero compensation	❑ Yes Ext. zero return

Keypad Description



↑ Parameter selection
Arrow key, scroll up

↓ Parameter selection
Arrow key, scroll down

Primary 1 Double function key
1. Direct access key Submenu Primary
2. Number 1

Units 2 Double function key Submenu Units
2. Number 2

Range 3 Double function key
1. Direct access key Flow Range Setting
2. Number 3

Output 4 Double function key
1. Direct access key Submenu Current Output
2. Number 4

Sys.zero 5 Double function key
1. Direct access key System Zero
2. Number 5

Em.pipe 6 Double function key
1. Direct access key Submenu Detector Empty Pipe
2. Number 6

Display 7 Double function key
1. Direct access key Submenu Display
2. Number 7

Damp. 8 Double function key
1. Direct access key Damping (Response Time)
2. Number 8

F1 9 Double function key
1. Direct access key F1 (user programmable)
Setting:
2. Number 9

F2 0 Double function key
1. Direct access key F2 (user programmable)
Setting:
2. Number 0

F3 . Double function key
1. Direct access key F3 (user programmable)
Setting:
2. Decimal point

F4 ENTER Double function key
1. Direct access key F4 (user programmable)
Setting:
2. ENTER
1. Program Protection ON or OFF
2. Use ENTER to change and accept new parameter values

C/CE Return to Process Information display:
Clear incorrect entry values

Tot. +/-
1. Key for sign -/+
2. To Submenu Totalizer, (for HART-Protocol Totalizer >F reset)

Contrast A small screwdriver can be used to adjust the contrast of the display for the local conditions.

CPU Control Processing Unit
The diode blinks when a CPU (Processor) failure is detected.
If this occurs contact the ABB-Service Department.

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