Operating Instruction

D184B022U02

Electromagnetic Flowmeter

Fill-MAG Converter
Model 50ES7000
for primaries in AC technology
Models: DS21, DS41F, DS44F

ABB

Product Designation
Fill-MAG Converter
Model 50ES7000

Operating Instruction

Part-No. D184B022U02

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1 Safety Information

1.1 Basic Safety Requirements

1.1.1 Instrument Safety Standards

- This instrument corresponds to the basic safety requirements of the Pressure Equipment Directive and is designed using the latest state-of-the-art technology. It was tested at the factory, based on the safety requirements, and was shipped in proper working order. In order to maintain this condition over the expected life of the instrument the requirements described in this Operating Instruction must be observed and followed.
- The instruments satisfy the EMC-Requirements in EN 61326 /NAMUR NE 21.
- All instrument parameters (including the totalizer values) are permanently stored in an NVRAM during a power outage or when the power is turned off. The instrument is immediately operational once the power is turned on again.

1.1.2 Correct Usage

This instrument is used

- to meter, during transport of electrically conductive liquids, slurries, pastes and sludges
- the actual volume flowrate or
- the mass flowrate (at constant pressure/temperature) when the mass units parameter is selected

Correct usage includes the following:

- installations compatible with the specification limits
- observing and following the statements in the Operating Instruction
- observing and following the information in the accompanying documents (Data Sheet)

The following equipment uses are not permitted:

- repairs, modifications, additions and the installation of replacement parts. These are only permitted using the procedures described in this Operating Instruction. Additional tasks must be approved by ABB. **Excepted are repairs made at ABB authorized facilities.** We accept no liability for unauthorized repairs.

The operation, service and maintenance requirements in this Operating Instruction must be observed. The manufacturer assumes no responsibility for damages resulting from improper or prohibited usage.

1.1.3 Specification Limits

The instrument is designed exclusively for use within the specifications listed on the Name Plate and in the Operating Instruciton. The following limits must be observed:

- the maximum fluid operating temperature in the Data Sheet may not be exceeded.
- the allowable ambient temperature range in the Data Sheet may not be exceeded.
- the allowable supply voltage may not be exceeded (see name plate or Data sheet).

1.1.4 Safety Signs and Symbols, Name Plate and CE-Mark

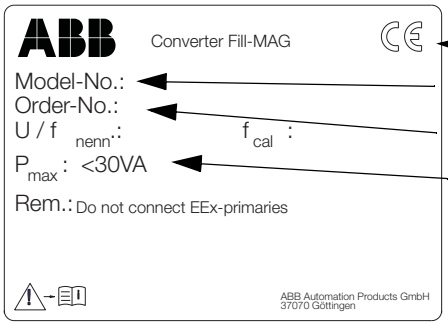
All safety signs, symbols and the Name Plate are to maintained in a readable condition and replaced if damaged or lost. Observe the following general information:

	**Warning!**	Indicates a risk or potentially hazardous situation which, if not avoided, could result in death or serious injury.
	**Caution!**	Indicates a potentially hazardous situation or alerts against unsafe practices which, if not avoided, may result in injury of persons or property damage.
	**Notice!**	Indicates a potentially harmful situation which, if not avoided, may result in damage of the product itself or of adjacent objects.
	**Important!**	Indicates useful hints or other special information which, if not observed, could lead to a decline in operating convenience or affect the functionality (does not indicate a dangerous or harmful situation!) Example: "Ready-made C-routines are available on the support disk.“
	**CE-Mark**	The CE-Mark confirms compliance of the instrument with the following guidelines and the fulfillment of their basic safety requirements: • **CE-Mark on the Name Plate (on the converter)** – Compliance with EMC-Directive 89/336/EEC – Compliance with Low voltage directive 73/23/EEC • **CE-Mark on the Name Plate (on the flowmeter primary)** – Compliance with Pressure Equipment Directive (PED) 97/23/EU A CE-Mark is not present on the Name Plate of instruments when: – the max. allowable pressure (PS) is less than 0.5 bar. – due to minimum pressure risks (meter sizes ≤ DN 25 [1“]) a compliance certification is not required. – instruments installed as water meters in Water/Waste Water treatment facilities. Applies to meter sizes >DN 600 [24”].

1.1.5 Name Plate Specifications

The Name Plate is mounted on the converter housing.

The Name Plate includes the following specifications:



- CE-Mark to certify the compliance with EMC-Directive 89/336/EEC
- Model number of the instrument
- Order number
- Converter power consumption

1.1.6 Personnel Qualifications

- Electrical installation, start-up and maintenance of the instrument should only be carried out by trained technicians who have been authorized to perform these tasks by the system operator. The personnel must read, understood and follow the instructions in this Operating Instruction.

1.1.7 User Responsibilities

Observe the National Codes in your country relative to the installation, functional tests, repair and maintenance of electrical equipment.

1.1.8 Possible Dangers During Electrical Installation

The electrical installation is to be completed by trained personnel in accordance with the Interconnection Diagrams.

- It is essential that the information notes relating to the electrical connections in this Operating Instruction be observed, otherwise the electrical protection type may be adversely affected.
- The leads for the supply power must be compatible with the applicable national and international standards. A separate fuse is to be installed for each instrument located near the instrument and appropriately identified. Protection Type of the converter is I. The Overvoltage category is II (IEC 664).
- The supply voltage and the circuits for the flowmeter magnet coil excitation are hazardous.
- The excitation and the signal circuits are only to be connected to the appropriate ABB flowmeter primaries. For the excitation circuit (magnet coil supply M1, M2) can be used standard cable type NYM 2x1.5 mm^2.
  For the flow signal connections cable D173B018U02 included with the shipment is to used.
- To all the other signal in-/outputs only circuits which are not hazardous or cannot become hazardous circuits may be connected.
- Ground the flowmeter system and the converter housing.

Caution!

When the housing cover is removed the EMC- and personnel contact protection are no longer provided.

1.1.9 Possible Dangers During Operation

Warning!

- There are hazardous circuits in the housing. Therefore the power should be turned off before the housing cover is opened.

1.1.10 Possible Dangers During servicing and maintenance

- Installation and repair tasks are only to be performed by trained personnel.
- There are hazardous circuits in the housing. Therefore the power should be turned off before the housing cover is opened.
- Repairs should only be made using original replacement parts from ABB.
- The instruments are maintenance free.

1.1.11 Returns

If it is necessary to return the instrument for repair or recalibration to the ABB factory in Göttingen, Germany, use the original packaging or other suitably protective packaging material. Please indicate the reason for the return.

2 Description of converter model 50ES7000

2.1 General

With the Fill-MAG flowmetering system the flowrate of all liquids, slurries and pastes with a minimum conductivity of 20 µS/cm can be accurately measured. The flowmeter primary can be equipped with a preampfilier to lower the minimum conductivity limit to 5 µS/cm or 0.5 µS/cm.

2.2 Design characteristics of the Fill-MAG

The electromagnectic Fill-MAG flowmetering system is distinguished by the following design characteristic:

- Especially suited for filling and dosing processes, from the smallest to the largest container sizes.
- Size range DN 1 to DN 400.
- Flowmeter system with automatic zero adjustment.
- Especially suited for the installation in the food industry (e. g milk, yogurt, juices, concentrates, beer, wine, etc.), the pharmaceutical industry (e. g acids, caustics, slimes, cleaning solutions and liquid washing materials) and the cosmetic industry (e. g shampoo and liquid soaps).
- Simple and easy cleaning and sterilization - automatic CIP cleaning cycles - due to the smooth and obstuctionless bore design of the primary metering tube.
- Simple and easy data entry and data recall in an Online mode using the comfortable foil keypad and the lighted dot matrix display or over a serial data link.
- Checking of the fillid volumes for over- and underfills.
- Remote recipe loading over the RS 485 data link.
- Simultaneous centralized parameter changes in up to 32 Fill-MAGs using the Remote Operator Unit (ROU) and the RS 485 data link.
- Measure backflow.
- High operational reliability through microprocessor controlled digital data processing and automatic self check features with error diagnostics.
- Four programmable batch and pre-batch quantities.
- Automatic overrun flow corrections available, smallest volumes can be filled with high precision.
- Reproducibility of ±0.2 % of rate, under reference conditions and homogen products.
- Fill-MAG available as a Volume Flow Integrator for appilications requiring certification.

2.3 General functional description of the converter

Four separate batch quantities with their corresponding pre-batch quantities and max. batch time intervals can be configured in the converter and stored for the dosing.

The individual batch quantities can be selected from the keypad, over the data link, or from contact inputs on the converter. Therefore a container size sensor can be utilized to set the appropriate batch quantity in so called “chaotic operation” (filling of a variety of container sizes in random order).

Statistical data for each batch quantity is accumulated in the converter; total flow, total number of fillings, total number of overfills and total number of underfills. These totalizers can be independently reset for each batch number.

Additionally the Fill-MAG converter 50ES7000 includes process monitoring and control functions as well as correction possibilities for the fill system related problems.

The display is a 2 × 16 dot matrix with background lighting. All parameters and control functions can be configured over the serial data link using two communication protocols (ASCII and µDSI-Binary). The instrument can be connected to a process control system or a protocol device without problems using the data link.

The input signals (Start, Stop, ext. batch number selection, ext. system zero adjust) as well as the output signals (pre-batch contact, end contact, alarm contact, system alarm contact) require an external +24 V dc supply.

The fill or dosing cycle start is initiated by an active 24 V dc signal from a button, SPC or PCS. The fill process begins with the start signal at which time the pre-batch and end contacts are closed. When the pre-batch quantity is reached the pre-batch contact is actuated (opens), when the batch quantity is reached the end contact is opened.

The fill or dosing cycle can be terminated by an external stop signal from a button or by a signal from the process control system over data link. The cycle is also automatically interrupted when an error is detected in the measurement system or when the freely configurable maximum batch time interval is exceeded.

After the fill cycle has been concluded the overrun flow due to valve response is measured and the pre-batch quantity automatically readjusted. After the overrun flow has been measured the zero is automatically measured and readjusted, when this feature is turned on. After the end contact has been actuated and the valve has been closed, the flowrate during this stoppage is monitored relative to the configured low flow cutoff valve. If the flowrate exceeds the specified limit (low flow cutoff +5 %) an error conditioned is signaled over the system alarm. In this manner pipe leaks or not fully closed valves can be recognized.

Every individual filled volume is checked for over- or underfilling against configured limits (in % based on the selected batch quantity). In the event of an incorrect fill an alarm is signalled with which a product ejection can be realized.

More information about the converter parameter lock to page 27 „Parameter overview“.

3 Output signals

The converter processes the flowrate proportional signals generated in the primary into a proportional frequency signal (unscaled pulse output). The unscaled 10 kHz frequency output is used internally in the converter. Direct pre-batch and end contact outputs for the valve control for the filling and dosing process are available. Further information regarding the in- and outputs may be found in the Block Diagramm page 64 and item 4.6, page 18.

Important

It is important to assure that the converter Model 50ES7000 is connected only to ac primaries of the Series DS21, DS41F and DS44F.

4 Assembly and installation

4.1 Checking the converter

Before installing the converter, check for possible shipping damage. All claims for damage must be promptly made to the shipper before installation.

4.2 Converter mounting

The mounting location for the converter should be essentially free of vibration. The specified ambient temperature limits of -20 °C to +50 °C are to be observed. The max. signal cable lenght between the primary and the converter for the standard and certified designs is 50 m and 200 m, for primaries equipped with low conductivity preamplifiers.

The mounting location should be selected so that the converter is not subjected to direct sunlight. Ambient temperatures above +50 °C will cause the readability of the LC-Display to decrease. Reading process data will no longer be possible. If direct sunlight cannot be avoided, a sun shield should be provided.

Important

This instrument corresponds to the NAMUR recommendations, „EMC Guidelines for Manufacturer and User of Electrical Instruments and Systems“ Part 1.

The instruments should not be installed in proximity to high powered electrical devices, e. g. thyristor controls, motors, control switches, etc.

Noise reduction devices such as protection diodes, varistors, or RC circuits should be provided for the valves and control switches of the system (VDE 0580).

The shields for the all leads are to be connected to ground.

4.2.1 Converter designs

Field mount housing
The housing is suitable for Protection Class IP 65 (DIN 40050). The lower section of the housing is mounted with 4 screws. For Dimensions and weight see Technical Data Converter on Page 77.

19’’-Converter module
The converter insert module corresponds to IP 00 (DIN 40050). The module is to be installed in a 19“ carrier which fits into all 19“ cabinet or modular housing in accordance with DIN 41494. For designs ang weight see Technical Data Converter on Page 77.

Insert cassette 28 TE
21 TE converter module with 7 TE control card.
Contact outputs: Relay
3 converter modules per modular housing.

Insert cassette 21 TE
21 TE converter module without separate control card.
Contact outputs: Optocoupler
converter modules per modular housing

4.3 Dimensions, Converter

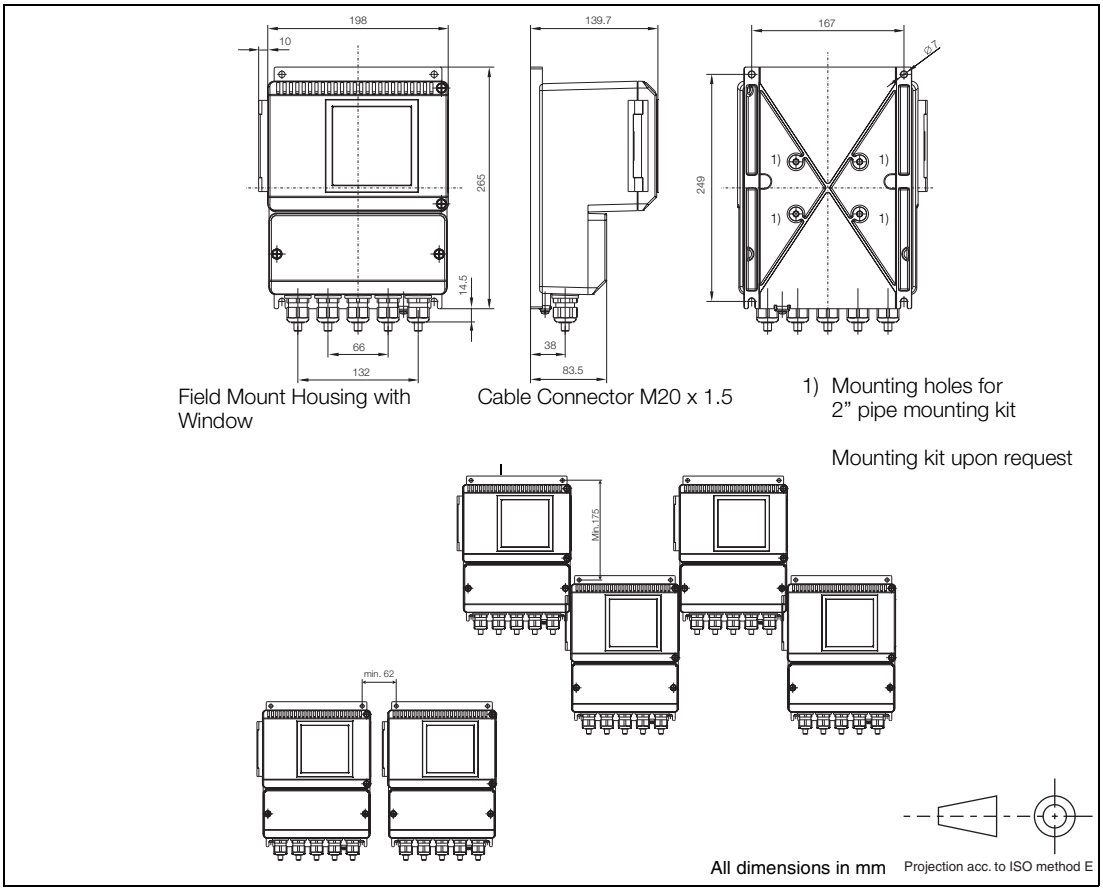


Abb. 1: Dimensions, field mounting housing

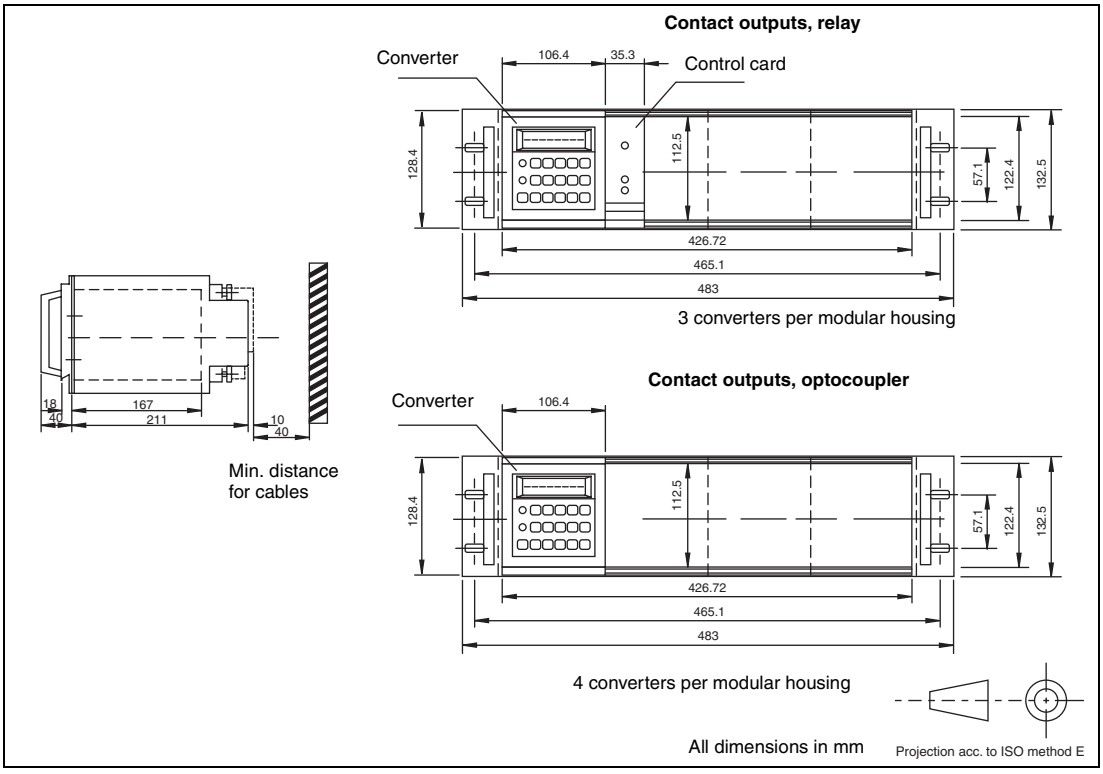


Abb. 2: Dimensions 19" insert module and 19" modular housing

4.4 Electrical connections, converter

4.4.1 Supply power connections

The supply power designated in the name tag is connected to terminals L (phase) and N (neutral) or 1L1 and 1L2 through a fuse and shut off switch. The conductor crossection and the fuse rating must be compatible (VDE 0100). The housing is grounded by a connection to PE/E.

4.4.2 Magnet coil supply current connections

The proper Interconnection Diagrams for the various primaries are to be observed (see Page 17). The connections are to be made as shown in the Interconnection Diagram.

Standard converter

The magnet coil current is supplied directly from the converter on terminals M1 and M3 using a cable a shielded (e. g (N)YM(ST)-J 2×1.5 mm²). The excitation voltage is approx. 60 V ac, 50/60 Hz. The exact value is recorded on the test report.

4.4.3 Power consumption

The power consumption is max. 30 VA.

4.4.4 Signal and reference cable connections

The signal cable lenght should be kept to a minimum because it is used to transmit an AC signal with an amplitude of only a few millivolts. It should not be run in proximity to large electrical machinery or switching elements from which stray fields and pulses may emanate. The signal may not be branched or spliced using terminal strips. If a plug connector is required between the primary and the converter a ABB prescribed plug type must be used.

The max. signal cable lenght for flowmeter primaries without preamplifiers is 50 m. If the primary has a low conductivity preamplifier installed, the max. cable length permitted is 200 m.

In the composite cable the shielded reference cable is run parallel to the signal leads. The cable contains a copper shield which encloses the individual shielded signal leads as well as the shielded reference cable. The shields of the individual signal leads serve as „driven shields“ for the measurement signal leads serve as „driven shields“ for the measurement signal transmission. The signal / reference cable is connected between the converter and the flowmeter primary as shown in the appropriate Interconnection Diagram.

The supply voltage for a preamplifier installed in the flowmeter primary is fed over the signal lead shields to terminals U+ and U− in place of terminal-code 1S and 2S.

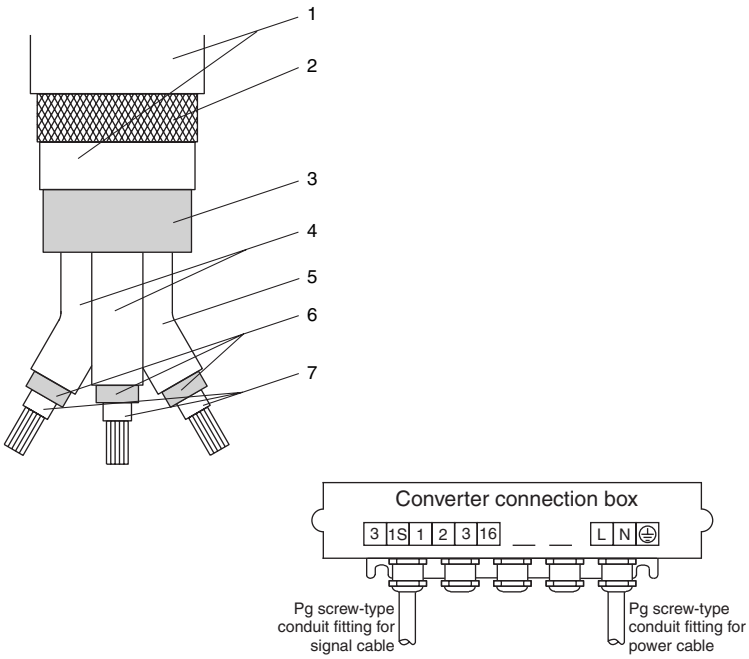
Points to be considered relative to the primary.

The primary should be installed in the pipe line in such a manner that the Pg screw-type conduit fitting point downward. If the actual flow direction does not correspond to the direction indicated by the flow arrow on the primary, the following measures can be followed. This are necessary since the contact outputs are not operational in the reverse flow direction.

Measures

a) For standard primaries the signal leads and their shields (only at the primary end of the cable) are to be exchanged:
   Terminal 1 with terminal 2
   Terminal 1S with terminal 2S

b) For primaries with preamplifiers only terminals 1 and 2 may be exchanged (only primary), because the terminals U+ and U- are used for the preamplifier supply power of ±12 V.



1 Insulation of PVC white

2 Cooper plait of wires ∅ 0.15 mm, cross-sectional

3 Cooper plait of wires ∅ 0.13 mm, cross-sectional

4 Flow signal

5 Reference signal Insulation, white

6 Screened Cooper plait of Co-wireg ∅ 0.1 mm

7 Polyethylen, natur

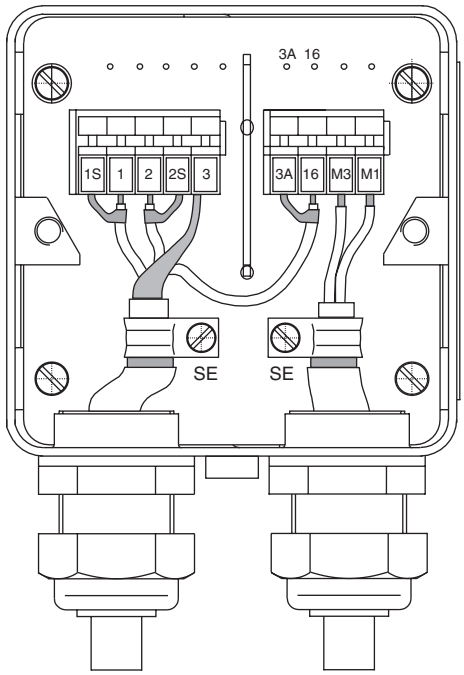
Abb. 3: Construction an Pg screw-type conduit fitting for signal and power cables

Important

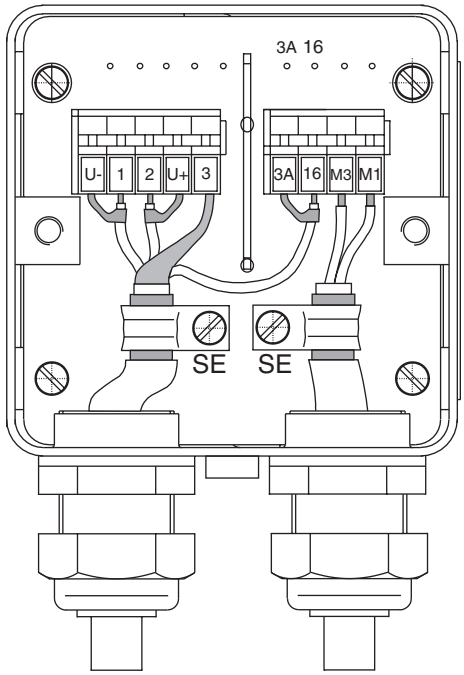
This instrument corresponds to the NAMUR recommendations „EMC Guidelines for Manufacturer and User of Electrical Instruments and Systems“ Part 1. A signal cable was developed in accordance with these recommendations incorporating a separate outer shield. This outer shield is to be connected to the terminal SE in the primary and to the terminal ⏚ in the converter. This cable is designated by ABB Part No. D173D018U02.

If the SE terminal is not present in the primary, then only connect the outer shield only at the converter-side.

4.4.5 Terminal designations in the connection boxes of the various converters



Terminals designation Standard	Connections
1 + 2 1S + 2S 16 3a 3	Electrode signal leads Electrode lead shields Reference signal lead Reference lead shield Outer shield
M1 + M3	Magnet coil supply (from converter)



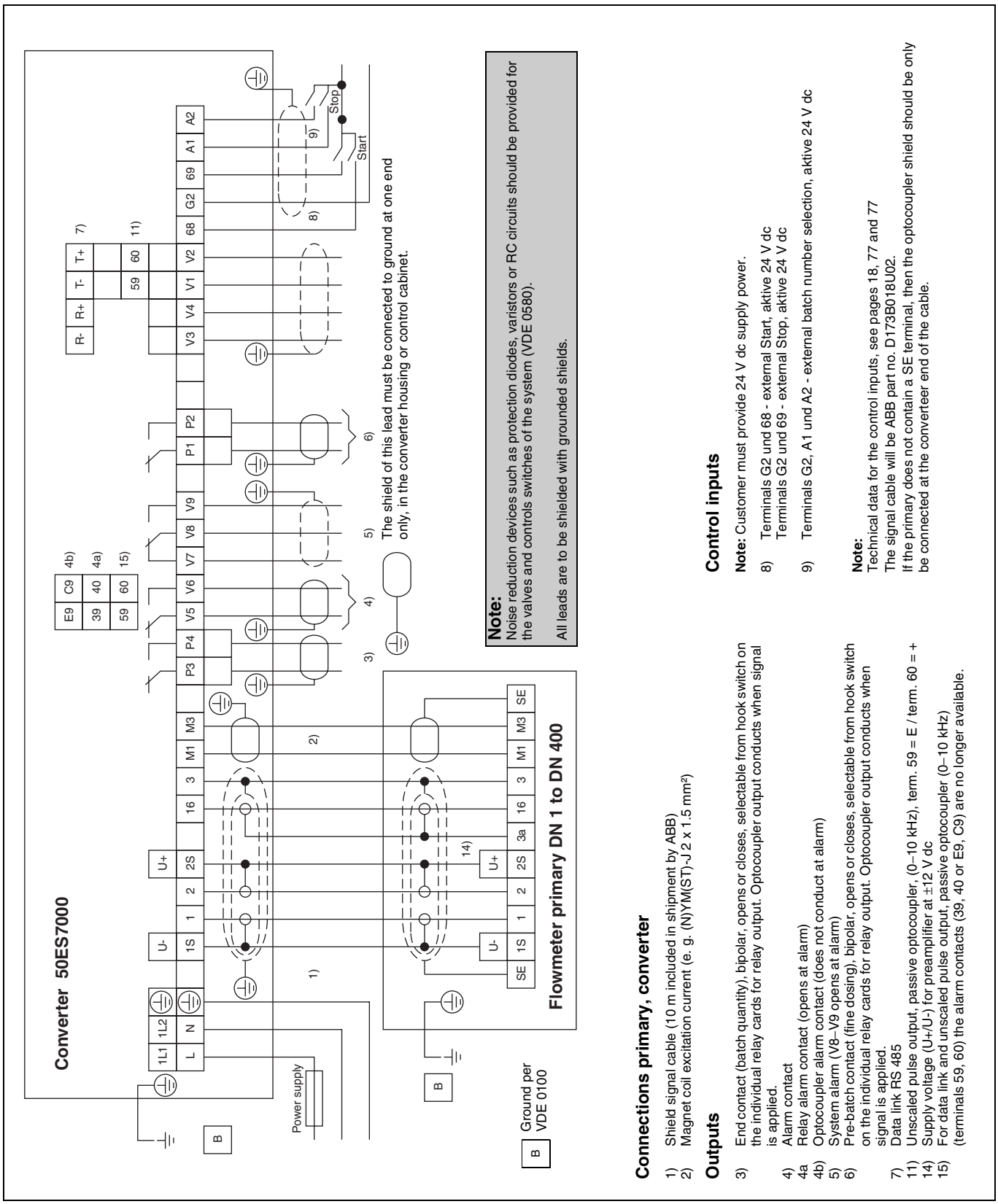
Terminal designations with preamplifier	Connections
1 + 2 U+ und U- 16 3a 3	Electrode signal leads 12 V supply voltage for preamplifier for low conductivities Reference signal lead Reference lead shield Outer shield
M1 + M3	Magnet coil supply (from converter)

Abb. 4: Customer connection box with terminal designations for primaries DS21, DS41F and DS44F in sizes DN 1 to DN 400 standard designs and with preamplifiers.

Notice

At times shields conduct signal potentials. When connecting the signal cable please assure that the inner and outer shields do not contact each other.

4.5 Interconnection diagram for flowmeter primaries models DS21, DS41F and DS44F in sizes DN 1 to DN 400 mm, in standard design and with preamplifier. Applicable to all converter designs!



Connections primary, converter

1) Shield signal cable (10 m included in shipment by ABB)
2) Magnet coil excitation current (e. g. (N)YM(ST)-J 2 x 1.5 mm²)

Outputs

3) End contact (batch quantity), bipolar, opens or closes, selectable from hook switch on the individual relay cards for relay output. Optocoupler output conducts when signal is applied.
4) Alarm contact
4a Relay alarm contact (opens at alarm)
4b) Optocoupler alarm contact (does not conduct at alarm)
5) System alarm (V8– V9 opens at alarm)
6) Pre-batch contact (fine dosing), bipolar, opens or closes, selectable from hook switch on the individual relay cards for relay output. Optocoupler output conducts when signal is applied.
7) Data link RS 485
11) Unscaled pulse output, passive optocoupler, (0–10 kHz), term. 59 = E / term. 60 = +
14) Supply voltage (U+/U-) for preamplifier at ±12 V dc
15) For data link and unscaled pulse output, passive optocoupler (0–10 kHz) (terminals 59, 60) the alarm contacts (39, 40 or E9, C9) are no longer available.

Control inputs

Note: Customer must provide 24 V dc supply power.

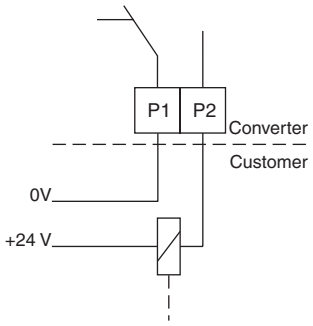
8) Terminals G2 und 68 - external Start, aktive 24 V dc
   Terminals G2 und 69 - external Stop, aktive 24 V dc
9) Terminals G2, A1 und A2 - external batch number selection, aktive 24 V dc

Note:
Technical data for the control inputs, see pages 18, 77 and 77
The signal cable will be ABB part no. D173B018U02.
If the primary does not contain a SE terminal, then the optocoupler shield should be only be connected at the converteer end of the cable.

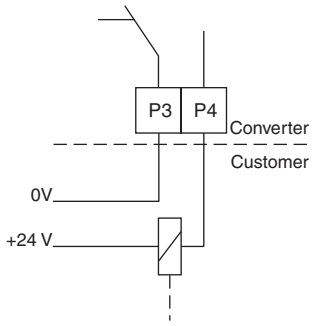
Abb. 5:

4.6 In- and outputs for converter 50ES7000

Pre-batch contact controls pre-batch quantity



End contact controls batch quantity



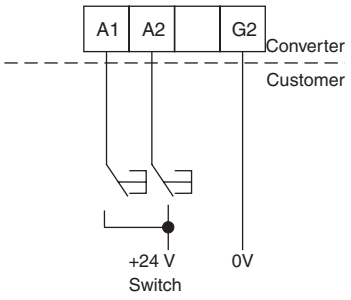
Contact settings
log. 0 = open
log. 1 = closed

Pre-batch contact		End contact		Operating mode
P1	P2	P3	P4	Relay design
0		0		Stop
1		1		Start fill
0		1		Pre-batch volume reached
0		0		Fill quantity reached

Noise reduction devices such as protection diodes, varistors or RC circuits should be provided for the valves and control switches of the system (VDE 0580).

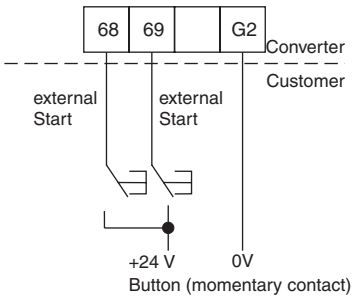
All leads are to be shielded with grounded shields.

Batch quantity selection
using external contact

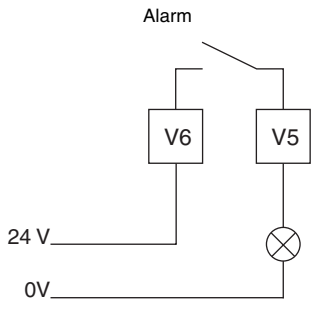


Voltage at		
A1	A2	Batch
0 V	0 V	4
24 V	0 V	3
0 V	24 V	2
24 V	24 V	1

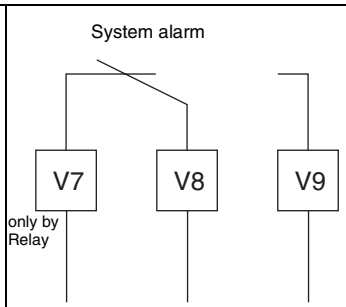
Ext. fill cycle control
Stop terminates fill cycle
Ext. system zero adjust using stop and start contact



Signalling



Operate: Contact closed
Alarm: Contact open



Operate: V8 - V9 closed
V7 - V8 open

Alarm: V7 - V8 closed
V8 - V9 open

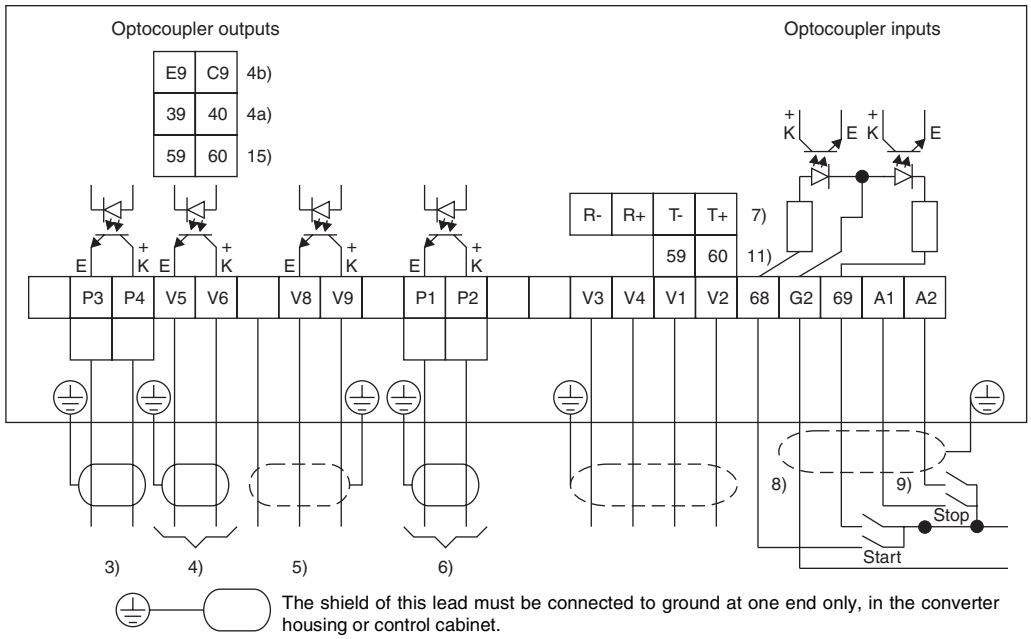
Electrical data:
allowable loads for

a) Relay contact
max. 28 V; 0,5 A; 8 W

b) Optocoupler output
$U_{CE} \leq 25$ V
$I_{CE} \leq 7{,}5$ mA

Abb. 6: In- and output contacts

4.7 Interconnection diagram for peripheral instruments



Electrical data:

Allowable loads for converter optocoupler outputs $U_{CE} \leq 25$ V, $I_{CE} \leq 7{,}5$ mA.

Legend see page 17.

Noise reduction devices such as protection diodes, varistors or RC circuits should be provided for the valves and control switches of the system (VDE 0580).

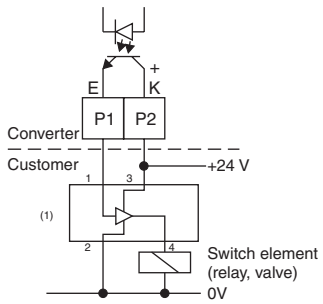
All leads are to be shielded with grounded shields.

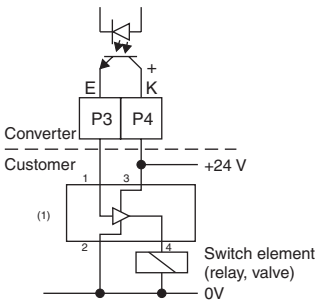
Abb. 7: Interconnection diagram for external amplifier with optocoupler output

Amplifier block (not standard)

current amplifier for weal current SPC signals for further use in the process.
(1) Amplifier block, e. g. Weidmüller DKV -24 V dc ±10 %, 0.5 A.

Pre-batch contact controls pre-batch quantity	**End contact controls batch quantity**	**Contact settings** log. 0 = open log. 1 = closed





Pre-batch contact		End contact		Operating
P1	P2	P3	P4	Relay design
0		0		Stop
1		1		Start fill
0		1		Pre-batch volume reached
0		0		Fill quantity reached

Abb. 8: Output contact configuration

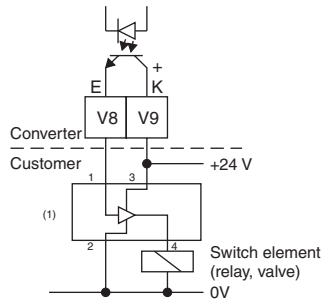
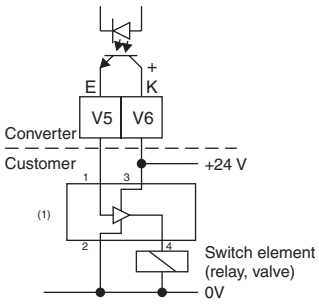
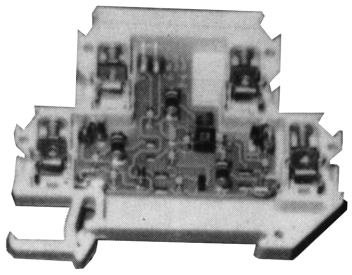
System alarm contact	Alarm contact	Amplifier block
 Operate: Optocoupler conducting Alarm: Optocoupler not conducting	 Operate: Optocoupler conducting Alarm: Optocoupler not conducting	 **Ordering information:** Type: DKV-24dc/32 (for 32 mm tracks) order no. 801578 Type: DKV-24dc/35 (for 35 mm tracks) order no. 801579

Abb. 9: Output contact configuration

Technical data

Input operating voltage	24 V dc ±0 %
Control current at U_N	5 mA
max. input power	550 mW
Threshold	13 ... 15 V dc
Output operating voltage	24 V dc ±10 %
max. load current	500 mA
max. voltage drop at max. output	≤ 450 mA
Quiescent current at 24 V	≤ 20 mA
Turn on delay	ca. 5 µs
Turn off delay	ca. 25 µs
max. switching frequency 1 : 1	3 kHz
Voltage insulation E/A-TS	4 kV_{eff}
Operating temperature	-25 °C bis +45 °C
Storage temperature	-40 °C bis +60 °C
Cable	AWG 22 ... 12
Conductor cross section	0.5 ... 4 mm

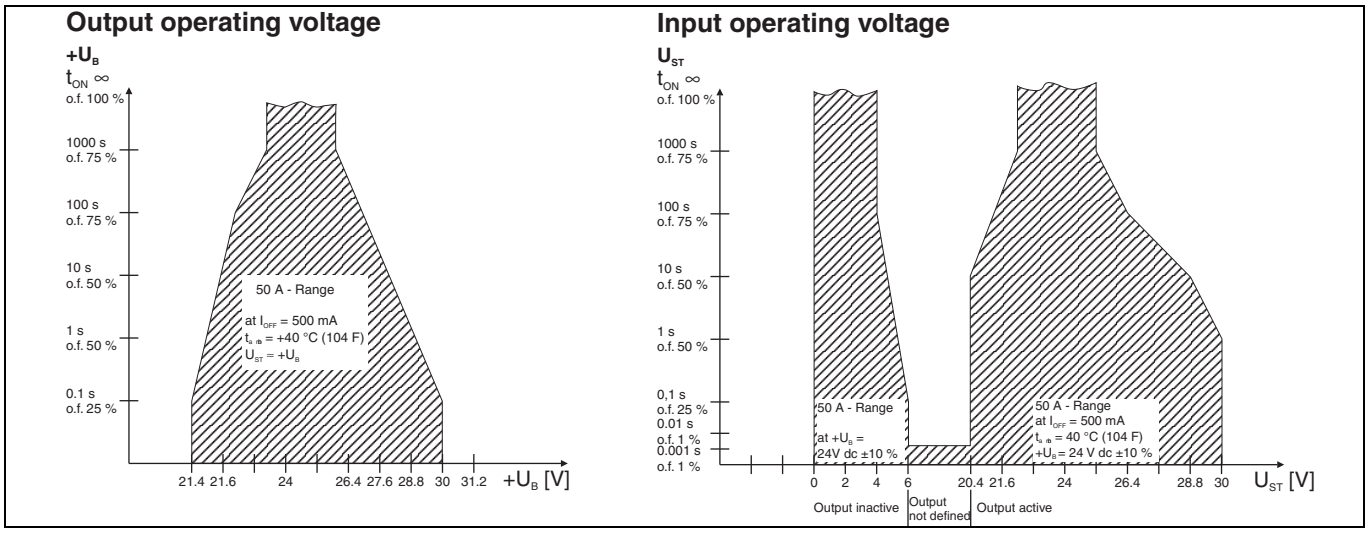


Abb. 10: Block diagram for the amplifier

5 Start Up

5.1 Checking the installation of the meter system

The primary should be installed in the pipe line in such a manner that the Pg screw-type conduit fittings point downward. If the actual flow direction does not correspond to the direction indicated by the flow arrow on the primary, the following measures can be followed. This are necessary since the contact outputs are not operational in the reverse flow direction.

Measures:

a) For standard primaries the signal leads and their shields (only at the primary end of the cable) are to be exchanged.
Terminal 1 with terminal 2
1S with terminal 2S

b) For primaries with preamplifiers only terminals 1 and 2 may be exchanged (only primary side), because the terminals U+ and U- are used for the preamplifier supply power of ±12 V dc.

Prior to start up of the instrument check if:

- that the interconnections are in accord with the Interconnection Diagram.
- that the supply power agress with the specifications on the name tag.
- that the primary is properly grounded (see Instruction Manual for primary).
- that the ambient conditions meet the conditions listed in the technical data sections.
- that the proper primary and converter are connected together (important for converters with fixed ranges, primaries with ac excitation).
- that the parameter configuration corresponds to the operating conditions.
- that the System zero has been set with the software (see 5.2 Zero Check).
- that all meter parameters for the specific meter location have been stored. So a simple replacement of the converter is possible, provided the parameters have been stored in the external EEPROM on the connection board (see Page 57, Sect. 7.3.37).

5.2 Zero Check

The system zero is to be set at start up or during checks of the system. The flow in the flowmeter must be brought to an absolute standstill. The meter spool must be guaranted full. The zero can be set either manually or automatically at the converter by accessing the parameter System Zero. Select the parameter with ENTER, and use the Arrow-keys to select e. g. Automatic and initiate with ENTER: During the automatic zero adjustment the 2nd line of the display on the converter counts from 0 to 255 during which the zero adjustment is made 7 times, after which the System Zero adjustment cycle is ended. The adjustment takes approx. 20 seconds and should be in the range of ±1500 Hz. See also Page 46 , Sect. 7.3.27.1.

Important

The data entered and the technical configuration of your instrument can be recorded on Overview Parameter Input and Settings section on Page 82.

The location and values of the fuses can be found on Fig. 13, up to 18.

6 Maintenance

The converter is maintenance free.

WARNING

According to the Waste Law of 27.08.86 (AbfG. 11 Special Waste) the owner of special wastes is responsible for the care and the employer also has, according to the Hazardous Material Law of 01.10.86 (GefStoffV, 17 General Protection Responsibility), a responsibility to protect his employees, we must make note that

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

b) the flowmeter primaries must be flushed so that the hazardous materials are neutralized. There are cavities in the primaries between the metering spool and the housing. Therefore after metering hazardous materials the cavities are to be neutralized (see Hazardous Material Low - GefStoffV). For two piece housings the screws used to hold the sections together should be loosened. For primaries ≥ DN 300 the drain plug at the lowest point in the hazardous materials and to neutralize the coil and electrode cavities.

7 Data Entry

7.1 General Description

Data entry and data recall can be made from the foil keypad (see Fig. 11) which simplifies operation of the converter. Almost all keys have double functions. During data entry the converter remains online, this means that entry values can be reviewed and / or changed without interruption of the process.

The review or changed of operating parameters is accomplished by pressing the direct access or arrow keys. After pressing a key the parameter name is displayed in the 1st line and its present value in the 2nd line. The direct access keys are used to access the parameters of the presently selected batch number.

Parameter changes, after the program protection is fist turned off, are made by pressing ENTER and stepping thought a table or by direct numerical entry of the new value. A return to the process display occurs automatically approx. 20 seconds after the last key has been pressed, or immediately by pressing C/CE.

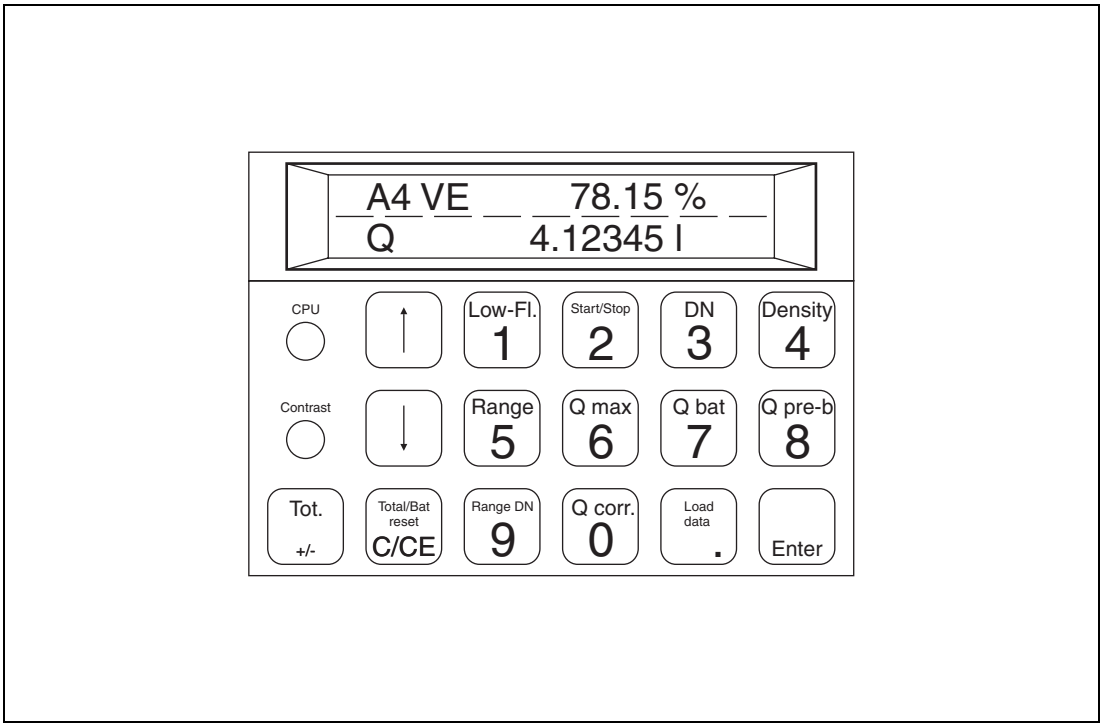
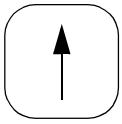


Abb. 11: Foil keypad with process indication

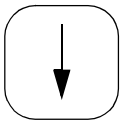
7.1.1 Foil keypad information

Important

Data can only be entered when the program protection has been turned off (parameter, program protection page 39)



Arrow key
Parameter selection, page upwards



Arrow key
Parameter selection, page downwards

Double function key:
1. Direct access key, parameter “Low Flow Cutoff”
2. Number 1 for numerial entry

Double function key:
1. Direct access key, parameter “Start fill”, “Stop fill”
2. Number 2 for numerial entry

Double function key:
1. Direct access key, parameter “Meter Size”
2. Number 3 for numerial entry

Double function key:
1. Direct access key, parameter “Density”
2. Number 4 for numerial entry

Double function key:
1. Direct access key, parameter “Range” (identical to Q_{max})
2. Number 5 for numerial entry

Double function key:
1. Direct access key, parameter “Range” (identical to Range)
2. Number 6 for numerial entry

Double function key:
1. Direct access key, parameter “Batch”
2. Number 7 for numerial entry

Q pre-b
8

Double function key:
1. Direct access key, parameter “Pre-batch quantity”
2. Number 8 for numerial entry

Range DN
9

Double function key:
1. Direct access key, parameter “Range DN at 10 m/s”
2. Number 9 for numerial entry

Q corr
0

Double function key:
1. Direct access key, parameter “Overrun quantity”
2. Number 0 for numerial entry

Load data
.

Double function key:
1. Direct access key, parameter “Load Data from External EEPROM”
2. Decimal point for numerical entry

Enter

Begin and conclude data entry

Total/Bat reset
C/CE

Double function key:
1. Direct access key, parameter “Totalizer Reset”
2. Return to process display (erase key)

Tot.
+/-

Double function key:
1. Display of the presently selected batch number together with display of the number of completed fills and totalized value for the batch number (for further information about the Arrow keys see “Overfilling”, “Underfilling”, “Print”)
2. Entry of negative numerical values

Kontrast

The contrast of the display can be modified by using a small screwdriver to suit the ambient conditions.

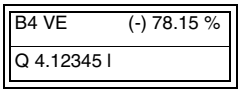
CPU

Control Processing Unit

(processor) errors result in a blinking diode.
Contact ABB Service assistance.

7.1.2 Display information

7.1.2.1 Process display during fill cycle



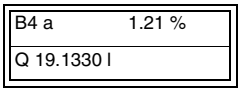
B4 B4 indicates the present batch number (in this example batch number 4 with 20 liters)

VE During filling VE is displayed. The symbol V for pre-batch contact and E for end contact indicate the presently active settings. When the pre-batch quantity and batch quantity are reached the symbols are extinquished.

78,15 % Display of the instantaneous flowrate. A negative value indicates reverse flow. If a reverse flow indication is continuously displayed, the measures described on Page 14, Sect. 4.4.4 should be followed.

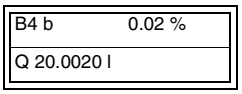
Q 4.12345 l Display of the actual totalized flow during the fill cycle.

7.1.2.2 Process display during overrun flow measurement



a The fill cycle has been completed (19.1330 l) and the end contact actuated. The „a“ indicates that the measurement of the overrun flowrate (at this moment 1.21 %) is in progress. A new start pulse during the overrun flow measurement cycle is ignored.

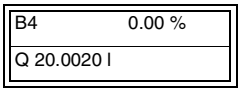
7.1.2.3 Process display during automatic zero adjust



b When the automatic zero adjust feature is turned on, the zero (in this case 0.02 %) is measured after the overrun flow measurement cycle has been completed. The symbol „b“ is displayed.

The automatic zero adjust cycle takes approx. 1 second and will be terminated by a start pulse.

7.1.2.4 Process display after completion of a fill, overflow measurement and zero adjust cycle



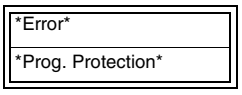
When the fill cycle has been completed the display for this example is as shown. The filled volume together plus the overrun quantity (0.869) is displayed.

7.1.3 Instructions for data entry

No special configuring background is required for data entry.

Input values can only be changed at the converter when the Program Protection has been turned off (see Page 39).

When the power is turned on, the Program Protection is always in the on mode, that means, no input data values can be changed. If an attempt is made to enter data while the Program Protection is on, the following message will be displayed:



To access to operating parameters, press the appropriate direct access key or page up or down through the menus with the Arrow-keys. The parameter name is displayed in the first line and its present setting with units in the second line.

The converter remains “on-line” during configuring, i. e. the current and pulse outputs continue to indicate the instantaneous values. Other control instruments connected to the converter need not be set to manuel while parameters are reviewed or changed. No internal totalizer information is lost.

7.1.3.1 Direct numeric entry

Select the parameter Prog. Protection ON and press ENTER or when a Protection Code No. is required enter same and press ENTER.

Parameters can be changed only when the Prog. Protection is OFF. The following procedure can be used to enter data.

1. Select desired parameter by pressing the appropriate direct access key or with the Arrow-keys. The parameter appears in the 1st display line and its present value with units in the 2nd line.
2. Press ENTER, the text remains in the 1st line, the value in the second line is erased and a blinking cursor appears. The converter awaits data entry. If no data is entered, the old value will reappear after appr. 20 seconds and after on additional delay the process display will reappear.
3. Data entry starts with the most significant digit. When ENTER is pressed the value is set and stored in the converter. If incorrect data has been inadvertently entered, it can be erased by pressing C/CE. To immediately return to the process display press C/CE again, otherwise it will take appr. 20 seconds for the process display to reappear.

3.1 The value set by ENTER is checked. If the value is outside the acceptable range, an error message will appear and the old value will be maintained. The message can be cleared by pressing C/CE or ENTER and the old value will reappear. To keep this value, proceed as previously described.

7.1.3.2 Tabular entry

After parameter access with ENTER, the desired tabular value can be accessed by scrolling with the Arrow-keys. When the desired value is located, press ENTER to accept. The converter checks the entry for validity. The routine can be terminated at any time by pressing C/CE.

7.1.3.3 Terminate progamming

Pressing C/CE erases the entry. The old data value will reappear when C/CE is pressed again. The process display will reappear when C/CE is pressed once more.

After data entry has been completed, the Prog. Protection should be turned on. Access the parameter Prog. Protection and press ENTER.

Program protection is on again.

7.2 Parameter overview with display in table format

Use key	Parameter 1st level	Parameter 2nd level	Parameter 3rd level	Entry mode	Comments
	Prog. Protection on			tab.	ON/OFF using ENTER (for order-no. = 0).
		ENTER → *Prog. Protection* off			OFF when code no. is entered ON when ENTER is pressed.
↑	Prog. Protection Code			num.	
		ENTER → Old Prog. Prot. Code? —			Enter old code no. and ENTER.
		↑ → New Prog. Prot. Code: —			Enter new code no. (between 0–255) and ENTER.
↑	Language German			tab.	German, English
		ENTER → Language ↑ German ↑ English			
↑	Batch selection Batch 1			tab.	Select batch 1–4 or activate the ext. batch selection „Ex-Contact“.
		ENTER → Batch selection ↑ batch 1 ↑ batch 2 ↑ batch 3 ↑ batch 4 ↑ Ex. Contact			
Q bat * 7	Batch quantity 1 50.0000 l			num.	Enter batch quantity 1.
		ENTER → Batch quantity 1 – l			

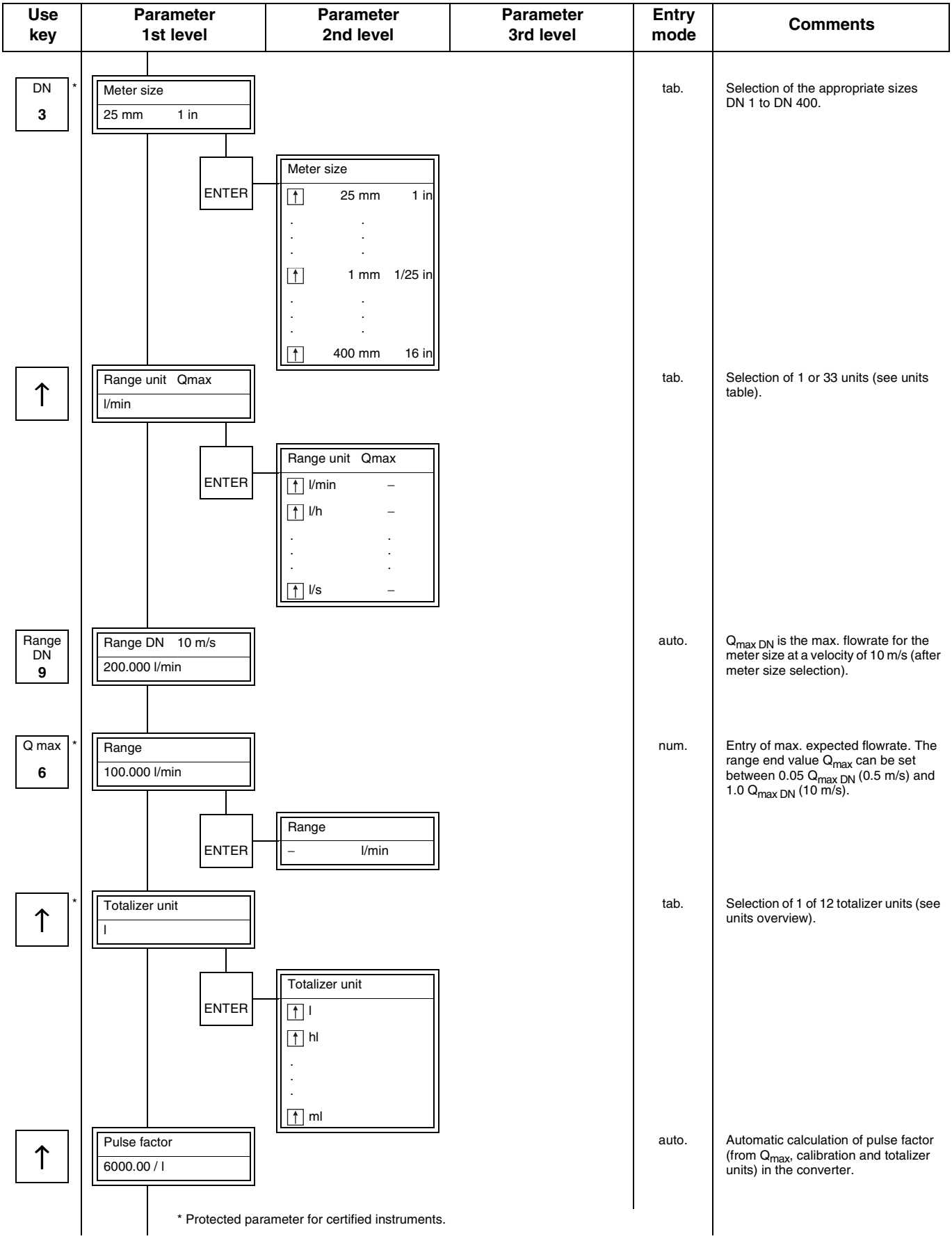
* Protected parameter for certified instruments.

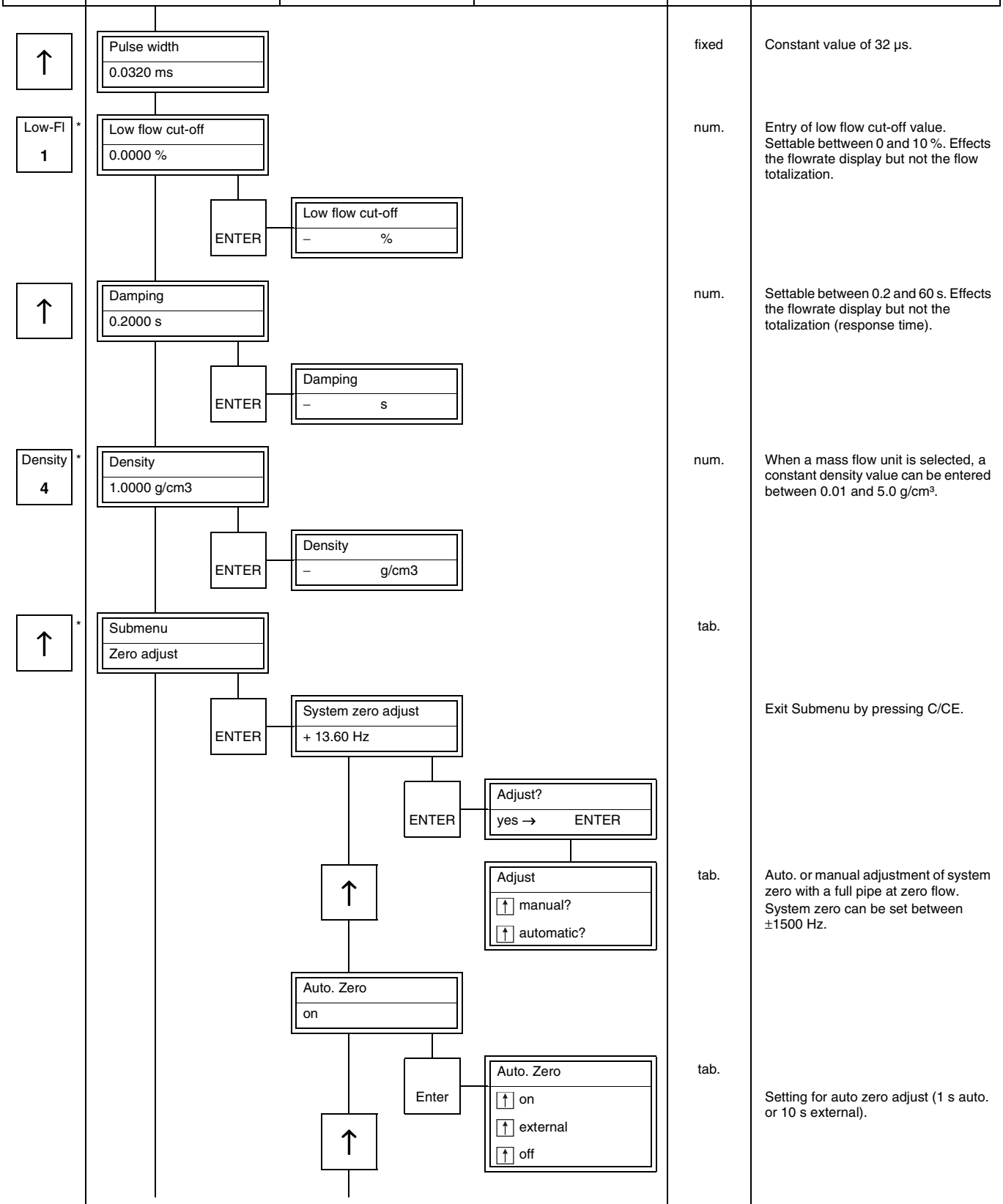
Use key	Parameter 1st level	Parameter 2nd level	Parameter 3rd level	Entry mode	Comments
Q pre-b **8**	Pre-batch quantity 1 47.0000 l	ENTER → Pre-batch quantity 1 – l		num.	Enter pre-batch quantity 1 for 2 stage fill cycle.
↑ *	Batch quantity 4 0.10000 l	ENTER → Batch quantity 4 – l		num.	Enter batch quantity 4.
↑	Pre-batch quantity 4 0.10000 l	ENTER → Pre-batch quantity 4 – l		num.	Enter pre.batch quantity 4 for 2 stage fill cycle.
↑	Overrun quantity 0.0209 l			auto.	This parameter displays the overrun quantity measured during the latest fill cycle.
↑ *	Overrun time 2000.0 ms	ENTER → Overrun time – ms		num.	The set the overrun flow measurement time interval (valve closing time and safety factor) between 10 and 2000 ms or 0.
Q corr **0** *	Overrun corr. - 0.023 l	ENTER → Overrun corr. – l		auto. (num.)	Correction amount which, when “Overrun quantity” is turned on, is calculated by the converter from “Overrun time”, “Overrun quantity” and the “Mean value corr.” = “0” a constant correction value can be entered.
↑	Mean value corr. 003	ENTER → Mean value corr. –		num.	Enter number of the overrun quantity measurement to be used in the correction factor calculation.

* Protected parameter for certified instruments.

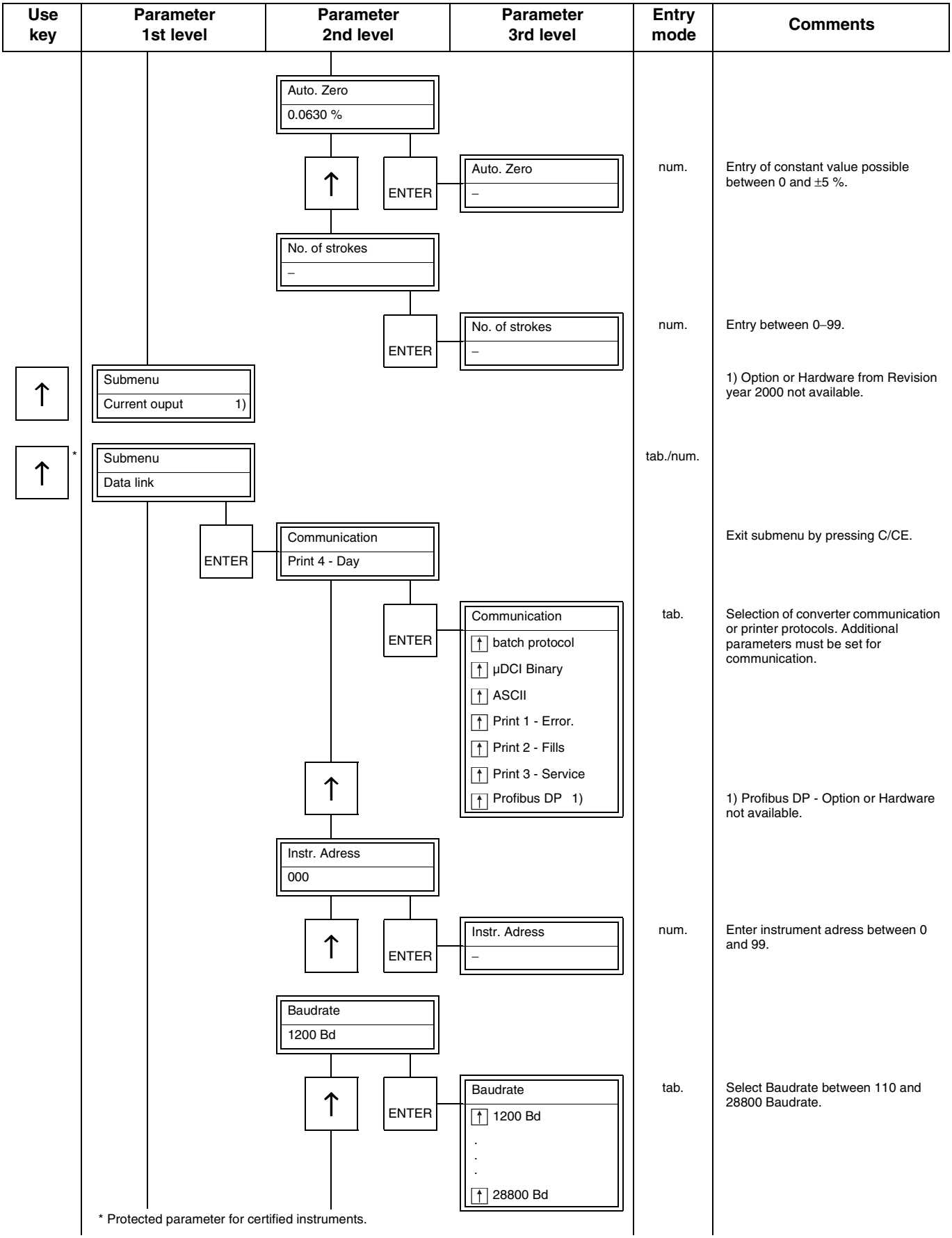
Use key	Parameter 1st level	Parameter 2nd level	Parameter 3rd level	Entry mode	Comments
↑ *	Splash loss amt. 0.0000 l	ENTER → Splash loss amt. – l		num.	Constant correction factor entry based upon loss quantity in the range of ±1000 (l, ml, ...)
↑ *	Calibration 0.0000 %	ENTER → Calibration – %		num.	Calibration of system (±10 %) and optimization of the meter.
↑	System alarm 100 ms pulse	ENTER → System alarm ↑ 100 ms pulse ↑ Static		tab.	Select pulse or static [constant] alarm contact.
↑	Max. batch time 1 60.000 s	ENTER → Max. batch time 1 – s		num.	Entry of maximum allowable fill cycle time. The end contact is automatically actuated when this time is exceeded. Can be set between 0 and 9999 s.
↑	Max. batch time 4 - Option is OFF -	ENTER → Max. batch time 4 – s		num.	To turn off max. batch time option ENTER 0 s.
↑ *	Overfilling 1.0000 %	ENTER → Overfilling – %		num.	Entry of max. allowable overfill in % (±40 %) based upon the selected batch quantity.
↑ *	Underfilling 0.5000 %	ENTER → Underfilling – %		num.	Entry of max. allowable underfill in % (±40 %) based upon the selected batch quantity.

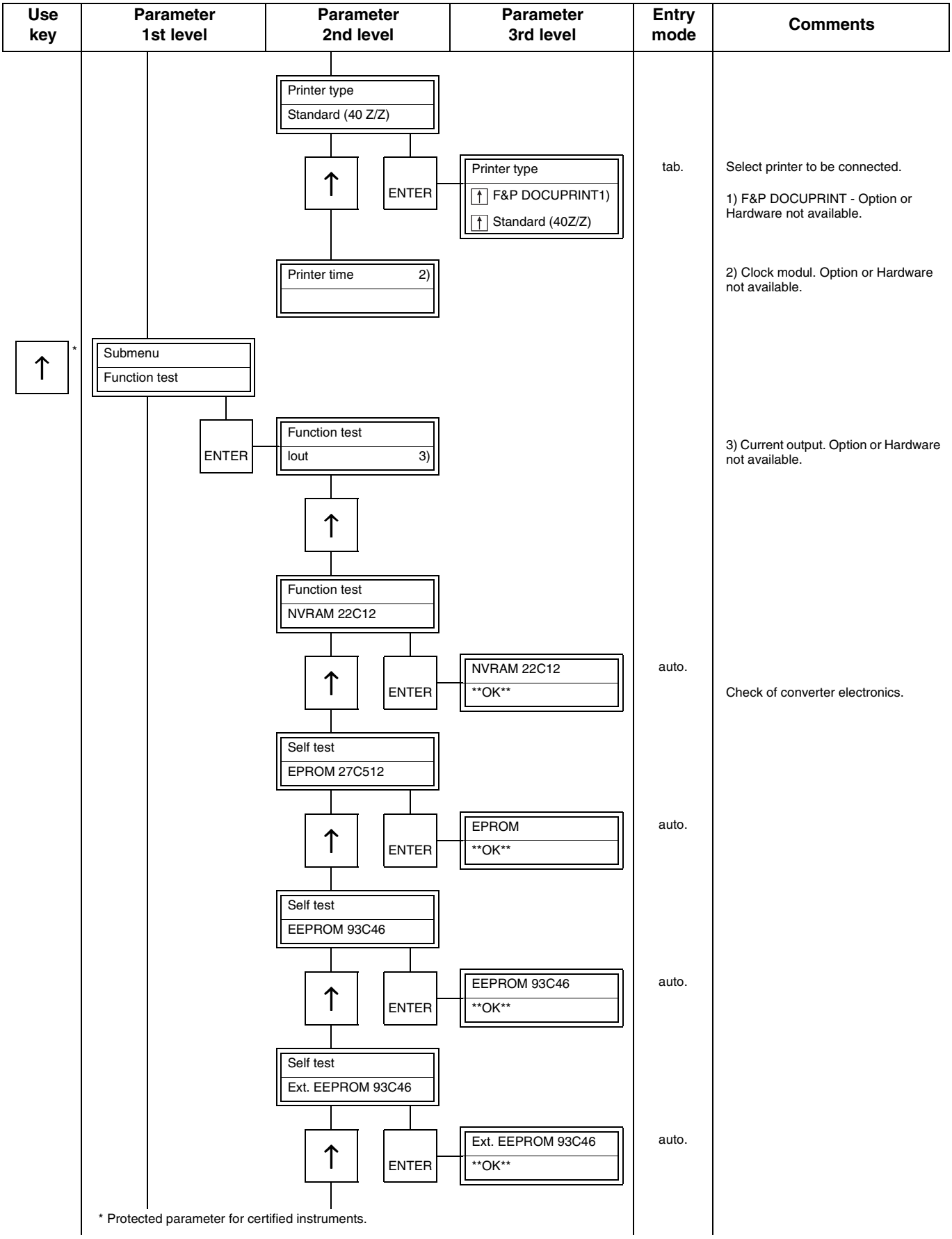
*Protected parameter for certified instruments.


Use key
Parameter 1st level
Parameter 2nd level
Parameter 3rd level
Entry mode
Comments
DN
3
*
Meter size
25 mm 1 in
tab.
Selection of the appropriate sizes DN 1 to DN 400.
ENTER
Meter size
25 mm 1 in
1 mm 1/25 in
400 mm 16 in
↑
Range unit Qmax
l/min
tab.
Selection of 1 or 33 units (see units table).
ENTER
Range unit Qmax
l/min –
l/h –
l/s –
Range DN
9
Range DN 10 m/s
200.000 l/min
auto.
$Q_{max\ DN}$ is the max. flowrate for the meter size at a velocity of 10 m/s (after meter size selection).
Q max
6
*
Range
100.000 l/min
num.
Entry of max. expected flowrate. The range end value Q_{max} can be set between 0.05 $Q_{max\ DN}$ (0.5 m/s) and 1.0 $Q_{max\ DN}$ (10 m/s).
ENTER
Range
– l/min
↑
*
Totalizer unit
l
tab.
Selection of 1 of 12 totalizer units (see units overview).
ENTER
Totalizer unit
l
hl
ml
↑
Pulse factor
6000.00 / l
auto.
Automatic calculation of pulse factor (from Q_{max}, calibration and totalizer units) in the converter.
* Protected parameter for certified instruments.



* Protected parameter for certified instruments.


Use key
Parameter 1st level
Parameter 2nd level
Parameter 3rd level
Entry mode
Comments
Auto. Zero
0.0630 %
ENTER
Auto. Zero
–
num.
Entry of constant value possible between 0 and ±5 %.
No. of strokes
–
ENTER
No. of strokes
–
num.
Entry between 0–99.
Submenu
Current ouput 1)
1) Option or Hardware from Revision year 2000 not available.
*
Submenu
Data link
tab./num.
ENTER
Communication
Print 4 - Day
Exit submenu by pressing C/CE.
ENTER
Communication
batch protocol
µDCI Binary
ASCII
Print 1 - Error.
Print 2 - Fills
Print 3 - Service
Profibus DP 1)
tab.
Selection of converter communication or printer protocols. Additional parameters must be set for communication.
1) Profibus DP - Option or Hardware not available.
Instr. Adress
000
ENTER
Instr. Adress
–
num.
Enter instrument adress between 0 and 99.
Baudrate
1200 Bd
ENTER
Baudrate
1200 Bd
28800 Bd
tab.
Select Baudrate between 110 and 28800 Baudrate.
* Protected parameter for certified instruments.

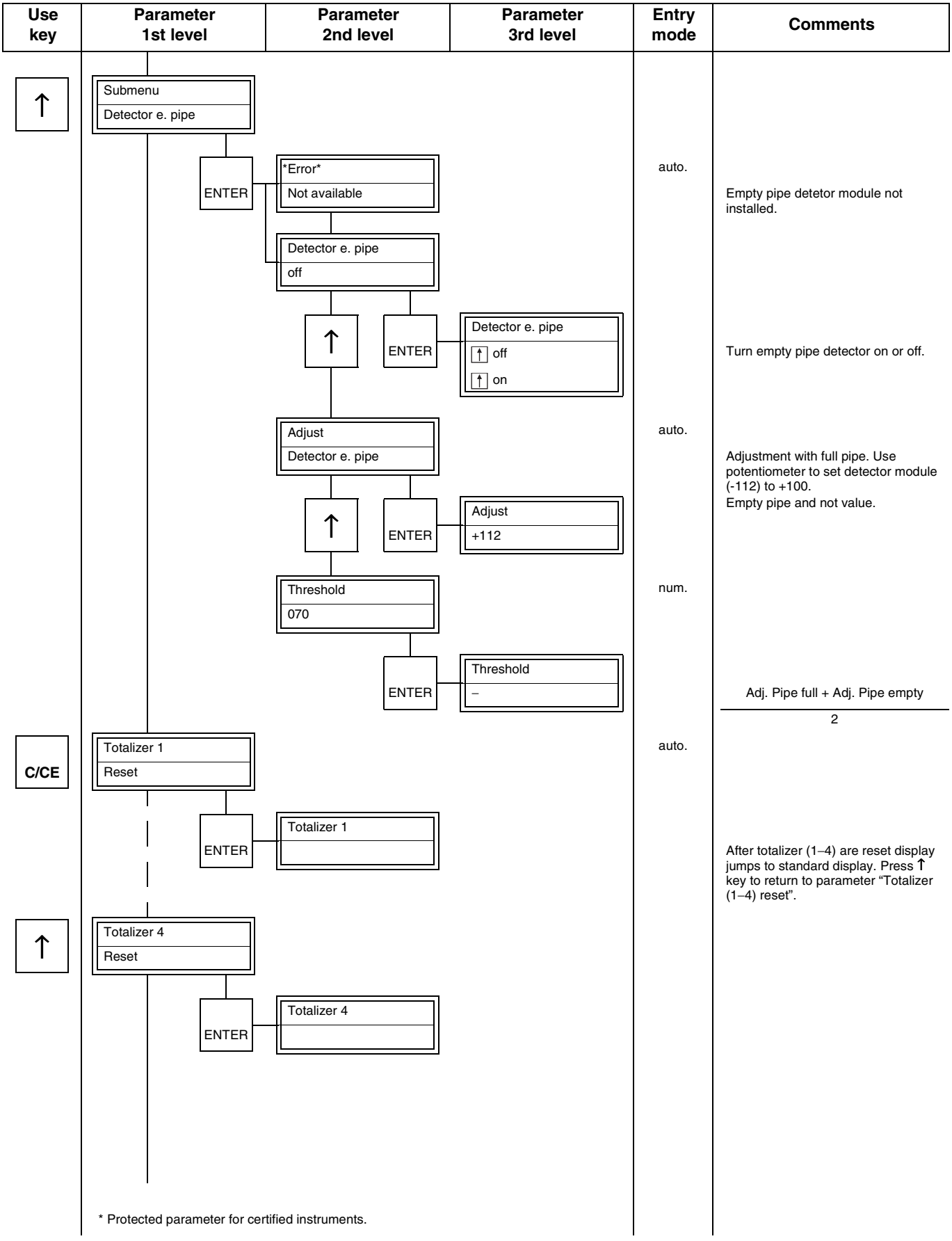

Use key
Parameter 1st level
Parameter 2nd level
Parameter 3rd level
Entry mode
Comments
Printer type
Standard (40 Z/Z)
ENTER
Printer type
F&P DOCUPRINT1)
Standard (40Z/Z)
tab.
Select printer to be connected.
1) F&P DOCUPRINT - Option or Hardware not available.
Printer time 2)
2) Clock modul. Option or Hardware not available.
*
Submenu
Function test
ENTER
Function test
Iout 3)
3) Current output. Option or Hardware not available.
Function test
NVRAM 22C12
ENTER
NVRAM 22C12
OK
auto.
Check of converter electronics.
Self test
EPROM 27C512
ENTER
EPROM
OK
auto.
Self test
EEPROM 93C46
ENTER
EEPROM 93C46
OK
auto.
Self test
Ext. EEPROM 93C46
ENTER
Ext. EEPROM 93C46
OK
auto.
* Protected parameter for certified instruments.

Use key	Parameter 1st level	Parameter 2nd level	Parameter 3rd level	Entry mode	Comments
		Self test Alarm contact			Check output contacts.
		↑ / ENTER	Alarm contact ↑ off ↑ on	tab.	
		Self test System alarms			
		↑ / ENTER	System alarms ↑ off ↑ on	tab.	
		Self test Pre-batch contact			
		↑ / ENTER	Pre-batch contact ↑ off ↑ on	tab.	
		Self test End contact			
		↑ / ENTER	End contact ↑ off ↑ on	tab.	
		Self test Switch S206			
		↑ / ENTER	Switch S206 off		On or off is displayed when switch S206 is actuated.
		Self test Switch S207			
		↑ / ENTER	Switch S207 off		On or off is displayed when switch S207 is actuated.

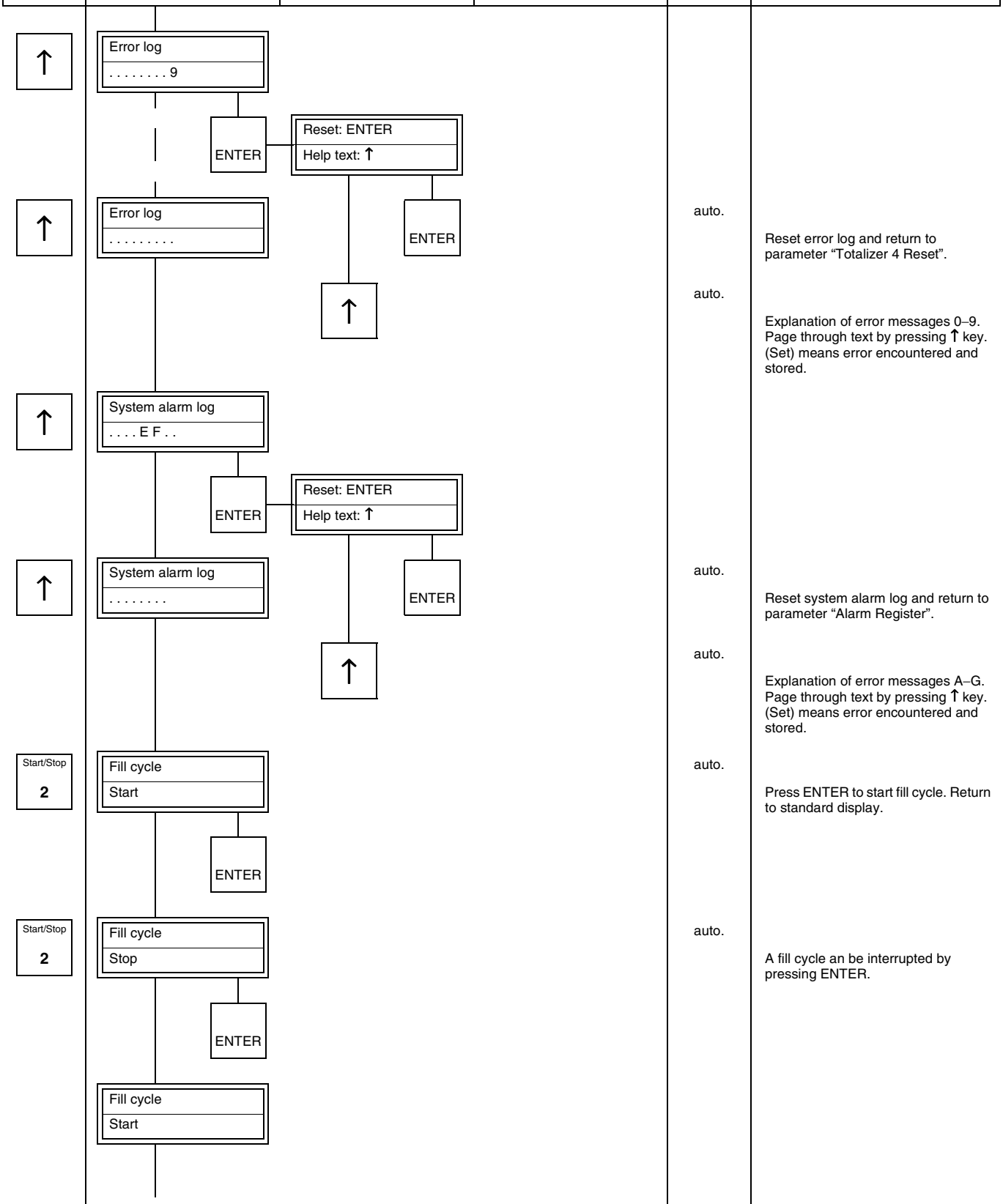
* Protected parameter for certified instruments.

Use key	Parameter 1st level	Parameter 2nd level	Parameter 3rd level	Entry mode	Comments
		Self test Ex. batch select			
		↑ ENTER	Ex. batch select Batch quantity 1	auto.	The selected batch quantity is displayed.
		Self test Data link			
		↑ ENTER	Data link 613 613	auto.	Short receiver to sender before data link test. Computer sends and monitor 1000 symbols.
		Self test Fout			
		↑ ENTER	Fout – Hz	num.	Enter output frequency between 0–13000 Hz.
		Self test Display			
		↑ ENTER	1234567890ABCDEF 1234567890ABCDEF	auto.	Check and control of display.
		Self test Start contact			
		↑ ENTER	Start contact off		Check of function by actuating start contact. On or off displayed. Pre-batch and end contacts not affected.
		Self test Stop contact			
		↑ ENTER	Stop contact off		Check of function by actuating stop contact On or off displayed. Pre-batch and end contacts not affected.

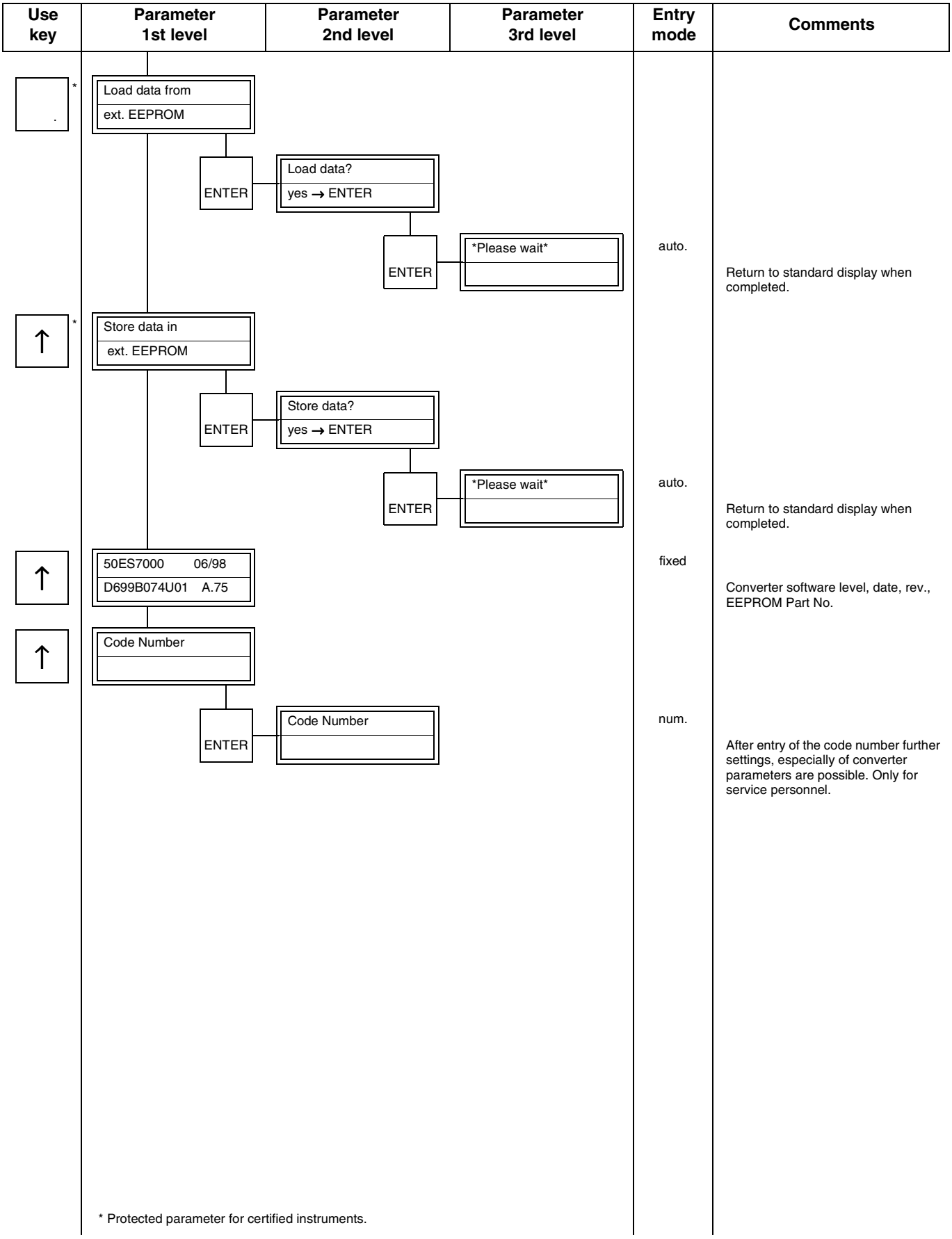
* Protected parameter for certified instruments.



* Protected parameter for certified instruments.



* Protected parameter for certified instruments.



* Protected parameter for certified instruments.

7.3 Parameter descriptions

Important

a) Parameters which may not be changed in certified systems are designated „Protected“. They are not accessible and can only be changed in the presence of an inspector. A new calibration is required after any „Protected“ parameters have been changed.

b) The direct access keys always select parameters corresponding to the presently selected batch number.

c) The procedure for selecting and configuring parameters is described in Section 7.2.

7.3.1 Program Protection

Prog. Protection
on

When the Program Protection is turned On, parameters values can only be reviewed. In order to change the values it is necessary to first turn the Program Protection Off. There are two methods available for turning the Program Protection Off:

a) In the converter without code number protection select the parameter Prog. Protection and press ENTER (configuration as delivered):

b) If the user has entered a freely programmable Protection Code no., then it must be entered before the Program Protection can be turned Off.

After the Program Protection has been turned Off, the following message is displayed:

Prog. Protection
off

The Program Protection can be turned on again by pressing ENTER. The Program Protection is automatically turned ON whenever the power is turned on or restored after an interruption as well as when an incorrect code no. is entered.

7.3.2 Program protection code no.

Prog. Procetion Code
1 2 3

The value set at the factory or after a reinitialization is 0. As long as the Code is set to 0, the Program Protection can be turned Off by pressing ENTER. If a different Code (0 to 255) has been set entering this number turns the Program Protection Off.

For procedure see section 7.2.

Important

The Program Protection Code is displayed when the ABB Service Code No. is entered.

7.3.2.1 Changing the program protection code

Old Prog. Prot. Code?
–

After selecting the parameter Prog. Prot. Code and pressing ENTER the present Code must be entered.

New Prog.Prot. Code:
–

The user can freely select a new Code after the Program Protection has been turned Off.

For changing code see section 7.2.

7.3.3 Language

Language
German

The display can be selected to show the text in German or English.

Language selection see section 7.2.

7.3.4 Batch Selection

Select batch
Batch 1

One of four available Batches can be selected. When any one of the Batches (1–4) has been selected the contact inputs for Ext. Batch Selection (A1, A2) are no longer available.

If the batch selection is to made from an external contact, select Ex. Contact in Batch Selection.

Important

Do not select Ex. Contact in the parameter Batch Selection when the selection is to made over the data link.

Selecting the batch see section 7.2.

7.3.5 Batch quantity 1, 2, 3, 4

Batch quantity 1
50.0000 l

Changing the Batch Quantity does not affect the Pre-batch Quantity. If the Batch Quantity is set lower than the existing Pre-batch Quantity, then the converter sets the corresponding Pre-batch Quantity equal to the Batch Quantity.

Important

The Batch Quantity may not be set less than the measured Overrun Quantity.

For entry of the batch quantity see section 7.2.

Possible error messages during data entry

Error No.	Cause
90	Entry too large
91	Entry ≤ 0

7.3.6 Pre-batch quantity 1, 2, 3, 4

Pre-batch quantity 1
47.0000 l

For fine dosing a Pre-batch Quantity is necessary. Through use of a contact to actuate an intermediate position in a two stage valve the flowrate in the end phase can be reduced.

Important

For fill times >approx. 3 seconds it is recommended to utilize the Pre-batch contact.

For fill times >5 seconds a 2-stage dosing should generally be utilized if possible in order to improve the repeatability.

For entry of the pre-batch quantity see section 7.2.

Possible error messages during data entry

Error No.	Cause
14	Entry > batch quantity
15	Entry < 0

7.3.7 Overrun Quantity

Overrun quantity
0.4601 l

The Overrun Quantity is only a display parameter wich cannot be changed manually. The converter determines the value upon completion of a fill cycle, but only when an Overrun Time has been entered. It is determined even when the automatic Overrun Correction is turned off (Mean Value Correction = 0).

The overrun quantity is a function of the closing time of the valve, the volumetric flowrate at the moment of turn off (single- or double stage filling), and the hopefully constant an reproducible flow velocity when the end contact is actuated (constant static pressure or level in the supply tank), as well as the reaction times of other devices in the system (e.g pilot valves and air supply for pneumatic valve operators, SPC reaction time, etc.).

If the overrun is constant after each fill cycle one can assume a reproducible valve closing characteristic and constant conditions.

7.3.8 Overrun time

Overrun time
300.00 ms

The Overrun Time can be set between 0 and 2 seconds in 10 ms steps.

This is the time interval during which the converter measures and corrects for the overrun flow. This value together with the Overrun Quantity is used in the Overrun Correction calculation.

Important

The Overrun Time must be greater than max. valve closing time plus a safety factor. If too short a time is selected, constant overfillings will result because the converter cannot measure the correct Overrun Quanity and determine the appropriate correction factor. The time interval for the measurement can be set between 0 and 2 seconds when the Automatic Zero Adjust is turned off. When the Automativ Zero Adjust is turned on the values may be set between 0.1 and 2 seconds. In this example 300 ms.

For entry of the overrun time see section 7.2.

Possible error messages during data entry

Error No.	Cause
88 89	Entry > 2000 Entry < 100

7.3.9 Overrun correction

Overrun corr.
-0.495 l

The Overrun Correction quantity represents the quantity before the total Batch Quantity at wich the end contact must be actuated. The Overrun Correction quantity can be determined automatically (7.3.9.1) or entered as a constant value (7.3.9.2)

7.3.9.1 Automatic

The Overrun Correction is calculated from the Overrun Quantity, the Overrun Time, and the Mean Value Correction. Thereby varying valve closing times are automatically compensated for by the converter.

7.3.9.2 Manual

When the Mean Value Correction is set to 0 an Overrun Quantity can be entered manually. The converter will always use this constant value. No correction will be made when a zero is entered in Overrun Correction.

Possible error messages during data entry

Error No.	Cause
84	Entry > ±1000

7.3.10 Mean value correction factor

Mean value corr. factor
010

The Mean Value Correction is the number of Overrun flow measurements which are to be averaged and used for the Overrun Correction algorithm. Only succesful fillings are used to build the average. Entering a zero turns the automatic correction feature off, so that a constant value can be used for the corrections.

Important

At start up a factor of 3 should be entered in order to quickly establish a correction factor. A factor between 5 and 10 is recommended once the system is running.

Possible error messages during data entry

Error No.	Cause
82	Entry > 100

7.3.11 Splash loss amount

Splash loss amt.
0.1000 l

A correction is available for a know amount of product wich is lost during the fill cycle and wich has been metered by the EMF (spray loss, dead space volume).

When a value is entered the Batch Quantity is increased (or decreased) by this amount. However the quantity displayed at the end of the cycle is the original Batch Quantity.

This parameter can be utilized to calibrate the system by entering a value. Values entered can be positive or negative.

Possible error messages during data entry

Error No.	Cause
86	Entry > ±1000

7.3.12 Calibration

Calibration
+0.1 %

This parameter can be utilized to make percentage changes to the calibration of the primary. This permits the optimization of the meter and system combination.

If a constant underfilling is determined during operation of the system by a standard volume measurement (certified keg, weigh scale, etc), then a positive calibration factor can be entered to compensate for this discrepancy, if overfilling occurs a negative value should be entered.

The calibration value can be calculated in the following manner:

Batch quantity:	50 liter
Actual fill quantity:	49.9 liter
Underfill quantity:	0.1 liter

0.1 liter based on the batch quantity of 50 liter is equivalent to 0.2%.

Since an underfilling has been measured a calibration factor of +0.2% must be entered. After subsequent Batch Quantity checks, a fine adjustment may be required (within +10% and up to 4 places after the decimal point). **When the actual quantity displayed agrees with the standerd volume measurement, the meter and system are optimized.**

The basis for the calibration is the proper installation of the instrument in accordance with the Instruction Manuals, a primary filled with product operating within the specified limits.

Possible error messages during data entry

Error No.	Cause
58	Entry > ±10 %

7.3.13 System alarm

System alarm
static

The System Alarm can be selected as a constant static signal or as a pulse with a 100 ms period (alarm automatically cancelled after 100 ms +10%).

7.3.14 Maximum batch time

Max. batch time 1
20.000 s

For each Batch Quantity a maximum fill time interval can be entered.

If the Maximum Batch Time entered (in this example 20 s) is exceeded (e.g valve sticks, static pressure too low) the cycle is immediately terminated. The System Alarm relay is actuated and „max. Batch Time“ is displayed. This function is turned off when a zero is entered.

Possible error messages during data entry

Error No.	Cause
60	Entry > 9999 s
61	Entry < 0 s

7.3.15 Overfilling

Overfilling
1.0000 %

The actual quantity filled is checked after each filling. The Overfilling parameter can be used to set the maximum acceptable overfill limit can be enter (in percent based on the Batch Quantity). If the measured quantity is greater than the maximum allowable quantity the system alarm is actuated and a corresponding message displayed. Additionally the corresponding overfilling counter, separate for each Batch Quantity, is incremented by 1.

This function is turned off when 0% entered.

Possible error messages during data entry

Error No.	Cause
66	Entry > 40 %
67	Entry < 0 %

7.3.16 Underfilling

Underfilling
0.5000 %

The actual quantity filled is checked after each filling. The Underfilling parameter can be used to set the maximum acceptable underfill limit can be enter (in percent based on the Batch Quantity). If the measured quantity is less than the allowable quantity the system alarm is actuated and a corresponding message displayed. Additionally the corresponding underfilling counter, separate for each Batch Quantity, is incremented by 1.

This function is turned off when 0% is entered

Possible error messages during data entry

Error No.	Cause
68	Entry > 40 %
69	Entry < 0 %

7.3.17 Meter size

Meter sizes	
25 mm	1 in

Meter Sizes listed in the following table may be selected.

The size in mm and in inches is displayed. The selection can be made using the Arrow keys. When a size is selected the values of Range DN and Range are set to the flowrate equivalent to a fluid velocity of 10 m/s. (Exception when RangeDN is set to be freely programmed). The sizes DN 1 to DN 400 are included in the table so that the converter can be connected to any size primary.

Flow ranges, meter sizes and pressure ratings

Meter size DN	in	Std. press. rating PN	min. Flow range flow velocity 0 to 0.5 m/s	max. flow range flow velocity 0 to 10 m/s	effective fluid velocity flow velocity 10 m/s / PTFE / PFA
1	1/25	40	0 to 0.03 l/min	0 to 0.6 l/min	10.61 m/s
1.5	1/17	40	0 to 0.05 l/min	0 to 1.0 l/min	9.43 m/s
2	1/12	40	0 to 0.1 l/min	0 to 2.0 l/min	10.61 m/s
3	1/8	40	0 to 0.2 l/min	0 to 4 l/min	9.43 m/s
4	5/32	40	0 to 0.4 l/min	0 to 8 l/min	10.61 m/s
6	1/4	40	0 to 1 l/min	0 to 20 l/min	10.05 m/s
8	5/16	40	0 to 1.5 l/min	0 to 30 l/min	9.95 m/s
10	3/8	40	0 to 2.25 l/min	0 to 45 l/min	7.89 m/s
15	1/2	40	0 to 5 l/min	0 to 100 l/min	10.38 m/s
20	3/4	40	0 to 7.5 l/min	0 to 150 l/min	8.55 m/s
25	1	40	0 to 10 l/min	0 to 200 l/min	6.53 m/s
32	1 1/4	40	0 to 20 l/min	0 to 400 l/min	7.26 m/s
40	1 1/2	40	0 to 30 l/min	0 to 600 l/min	7.92 m/s
50	2	40	0 to 3 m³/h	0 to 60 m³/h	8.00 m/s
65	2 1/2	40	0 to 6 m³/h	0 to 120 m³/h	9.54 m/s
80	3	40	0 to 9 m³/h	0 to 180 m³/h	10.64 m/s
100	4	16	0 to 12 m³/h	0 to 240 m³/h	8.14 m/s
125	5	16	0 to 21 m³/h	0 to 420 m³/h	9.40 m/s
150	6	16	0 to 30 m³/h	0 to 600 m³/h	9.15 m/s
200	8	10/16	0 to 54 m³/h	0 to 1080 m³/h	9.64 m/s
250	10	10/16	0 to 90 m³/h	0 to 1800 m³/h	9.95 m/s
300	12	10/16	0 to 120 m³/h	0 to 2400 m³/h	9.34 m/s
350	14	10/16	0 to 165 m³/h	0 to 3300 m³/h	10.49 m/s
400	16	10/16	0 to 225 m³/h	0 to 4500 m³/h	10.79 m/s

7.3.18 Range units

Range unit
l/min

The units listed below can be selected by using the Arrow keys. The selected applied to Range DN and Range.

Unit totalizer	Units flow rate			
Unit	./second	./minute	./hour	./day
Milliliter	ml/s	ml/min	ml/h	
Liter	l/s	l/min	l/h	
Hectoliter	hl/s	hl/min	hl/h	
Cubic meter	m³/s	m³/min	m³/h	
Imperial-gallon per	igps	igpm	igph	
U.S.-mill-gallon per day				mgd
U.S.-gall per		gpm	gph	
Beer barrel	bbl/s	bbl/min	bbl/h	
Petrochemical barrel		bls/min	bls/h	bls/day
Gram	g/s	g/min	g/h	
Kilogram	kg/s	kg/min	kg/h	
Ton (metric)	t/s	t/min	t/h	
Units table				

7.3.19 Range max. for the meter size at 10 m/s

Range DN 10 m/s
200.000 l/min

Range DN is the flowrate equivalent to a flow velocity of 10 m/s for Meter Size selected. The values for Range DN, which cannot be changed, are listed in the Meter Size Table.

In general Range DN is configured when Meter Size selected. The possibility to freely program Range DN for special circumstances is possible. For further information see Service Manual.

7.3.20 Range

Range
100.000 l/min

The Range end value can be set between 0.05 Range DN an 1.0 Range DN (for certified systems between 0.3 Range DN and 1.0 Range DN).

This parameter can be used to expand the range.

Example DN 25:

A flow velocity of 2 m/s (40 l/m) results in a display of 20% when the Range is set to 200 l/min. In order to operate in regions of higher resolutions the expected flowrateshould lie between 80 and 100%. This would require a Range setting of 40 l/min. Decreasing the Range by a factor of increases the flowrate display (resolution) by a factor of 5 to 100 %.

Possible error messages during data entry

Error No.	Cause
10	Entry > 1.0 RangeDN > 10 m/s
11	Entry < 0.05 Range DN < 0.5 m/s

7.3.21 Totalizer units

Totalizer units
l

The unit applies to the Batch Quantities, the grand total Totalizer, and the individual Totalizers as well as to the Overrun Quantity, Overrun Correction, and Splash Loss Amount.

Unit	
ml	Milliliter
l	Liter
hl	Hectoliter
m^3	Cubic meter
igal	Imperial Gallons
gal	US Gallons
mgal	US Million Gallons
bbl	Beer Barrels
bls	Liquid Barrels
g	Gram
kg	Kilogram
t	Ton

7.3.22 Pulse factor

Pulse factor
6000.00 /l

The Pulse Factor for the unscaled pulse output is for indication purposes only and cannot be changed. The Pulse Factor is determined in the converter from the parameters Range (changes when the Meter Size or Range settings are changed), Totalizer Units and the Calibration Factor in such a manner that the 10 kHz pulse frequency occurs at 100 % flow. This assures maximum resolution.

7.3.23 Pulse width

Pulse width
0.0320 ms

The Pulse Width of the unscaled pulse output is fixed at 0.032 ms and cannot be changed.

7.3.24 Low flow cut-off

Low flow cut-off
0.0000 %

The Low Flow Cut-off range can be set between 0 and 10 % of the Range. It affects only the instantaneous flowrate display. The display are set to zero when the floerate drops below the Low Flow Cut-off value.

The flowrate totalization continues even for flowrates below the Low Flow Cut-off value.

Important

The Low Flow Cut-off value should generally be set to zero.

Possible error messages during data entry

Error no.	Cause
16	Entry > 10 %
17	Entry < 0 %

7.3.25 Damping

Damping
0.2000 s

The Damping can be set between 0.2 and 60 seconds. This value corresponds to the time (5) for the output to move to 99% of a step change value. The Damping affects the instantaneous flowrate display. The integration of the flowrate is not influenced.

Important

The Damping is generally set to 0.2 s.

Entering Damping values together with short fill cycles at high flowrates may result in momentary flow excudions above 130 % which will not be measured resulting in overfillings.

Possible error messages during data entry

Error no.	Cause
20	Entry > 60 s
21	Entry < 0.2 s

7.3.26 Density

Density
1.0000 g/cm3

For gravimetric units, g, kg, and t a constant Density value can be entered for mass flowrate calculations. The Density can be set between 0.01 and 5 g/cm³, only when gravimetric units have been previously selected. For other units a constant value of 1.0000 g/m³ is diplayed in the second line.

Possible error messages during data entry

Error no.	Cause
44	Entry > 5 g/cm³
45	Entry < 0.01 g/cm³

7.3.27 Submenu zero adjust

Submenu
Zero adjust

All the settings for the automatic System Zero Adjust are contained in this parameter. The adjustment of the System Zero as well as the automatic zero adjustment options (on/off, external, Number of Strokes [Samples], etc.) are provided in this submenu.

1. System Zero Adjust

a) Adjust Manual
b) Adjust Automatic

2. Automatic Zero Adjust

a) On
b) External
c) Off

3. Automatic Zero Adjust
4. Number of Strokes [Samples]

7.3.27.1 System zero adjust

System zero adjust
+13.60 Hz

The System Zero value is always based upon the Range DN value of 10 m/s. It can be set between ±1500 Hz.

During start up and initial system check out as well as when converters are exchanged a system Zero Adjust procedure should be run from the converter. For this procedure the metering tube in the primary must be completely filled and at zero flowrate. The Zero Adjustment can then be made automatically from the converter.

It is also possibble to use a manual procedure.

Procedure for setting zero see 7.2.

Adjust?
yes→ENTER

After selecting the System Zero Adjust by pressing ENTER the following message is displayed for safety reasons.

a) Manual adjustment

Adjust
manual?

Using ENTER and the number keys the value for the System Zero can be entered. When the Automatic System Zero Adjust is turned off the converter uses this constant value for the system zero.

If a System Zero value > 1.5 kHz is entered an error message is displayed and the System Zero is set to 0.

Possible error messages during data entry

Error no.	Cause
54	Zero value > 1.5 kHz

b) Automatic zero adjustment

Adjust
automatic?

The System Zero Adjust can be carried out automatically using the ENTER and Arrow keys. Pressing ENTER imitates the automatic zero adjustment procedure. A count from 0 to 255 is displayed. The procedure is repeated eight times.

The zero value must lie within the plausible range of ±1.5 kHz, otherwise an error message is displayed and the installation of the metering system should be checked.

The procedure can be terminated by pressing C/CE. In this case the value is set to zero Hz.

Possible error messages during data entry

Error no.	Cause
54	Zero value > 1.5 kHz

7.3.27.2 Automatic zero adjust

The automatic zero adjustment can be turned on or off in this parameter or External Zero Adjustment can be selected. The adjustment can only be initiated when the flowrate is zero (see section 7.3.8).

a) On

Auto. Zero
on

The 50ES7000 converter includes an Automatic Zero Adjustment capability. The zero can be measured for 1 s after the completion of each fill cycle. The zero value is calculated from the average of a number of these measurements (see Section 7.3.27.4).

The zero measurement will be terminated by a new Start pulse.

Possible error messages during data entry

Error no.	Cause
94	Entry > ±5 %

b) External

Auto. zero adj.
external

The External Zero Adjustment is initiated from the external Stop and Start inputs must be active for at least 2 seconds whereby it should be noted that the Stop contact must be actuated at least 100 ms before the Start contact.

The adjustment takes 10 seconds and cannot be interrupted. During this 10 seconds interval both inputs must be reset.

When External Zero Adjustment is selected stars (***) are displayed in the Number of Strokes [Samples] parameter.

c) Off

Auto. zero adj.
off

When the Automatic Zero Adjust is turned off stars (***) are displayed in the parameters Auto Zero Adj and Number of Strokes.

7.3.27.3 Automatic zero display

Auto. Zero
0.0630 %

The zero value measured by the computer is displayed. The value can be changed manually. The value in percent is always based on the flowrate selected in Range. A minus sign denotes a negative zero value.

7.3.27.4 Number of strokes

No. of strokes
005

The number of zero measurements to be averaged for the automatic zero adjustment can be set in this parameter. The average of the zero measurements is used for the Automatic Zero Adjustment.

Stars (***) are displayed in the second line when External or Off have been selected.

Possible error messages during data entry

Error no.	Cause
95	Entry > 99

7.3.28 Submenu current output

Option of Hardware from revision year 2000 not available.

7.3.29 Submenu data link

Submenu
Data link

The following parameters can be selected in this submenu:

1. Communication
2. Instrument Address
3. Baudrate
4. Printer Type
5. Time Printout (Option of Hardware from revision year 2000 not available)

If a serial data link is not installed in the converter, the following display will appear if this submenu is selected by pressing ENTER:

Error
Not available

7.3.29.1 Communication

When this parameter is selected the desired communication protocol (ASCII or µDCI-Protocol) or one of the 4 standard printer protocols implemented in the converter can be selected.

All parameters, totalizer values, and control function of the converter can be accessed over the data link.

a) µDCI Protocol

Communication
µDCI Binary

µDCI-binary is a specialized ABB protocol and is compatible with the µDCI family of instruments. It should be selected when the converter is used in conjunction with a Supervisor-PC or a ABB Process Control System.

Further information is available in the µDCI Data Link Protocol manual.

b) ASCII-protocol

Communication
ASCII

If the converter is used in conjunction with a Remote Operator Unit (ROU) or a printer the ASCII communication protocol should be selected.

This protocol should also be selected if communication between the converter and a PC is to be established.

Further information is available in the ASCII Data Link Protocol manual.

c) Print 1 - Fill Error (Printer 1)

Communication
Print 1 - Fill Error

This protocol automatically produces a printer output when a overfilling has occured.

```
overfilling
Instr. No..     0

B1 No.          5
Q 30.0083 l
```

B1 = Batch quantity1
No. = Number of the fill
Q = Filled quantity
Qa = Entered batch quantity (“Underfilling” set to 0.0005 %)

d) Print 2 - Batch quantity (Printer 2)

Communication
Print 2 - Batch

This protocol automatically produces a printer output after each filling.

```
Instr. No.      0
B1 No.          1
Q  29.9990 l
Qt 29.9990 l

Instr. No.      0
B1 No.          2
Q  10.8396 l
Qt 40.8386 l

Instr. No.      0
B1 No.          3
Q  30.0130 l
Qt 70.8516 l
```

B1 = Batch quantity 1
No. = Number of the fill
Q = Filled quantity
Qt = Total filled quantity

e) Print 3 - Service (Printer 3)

Communication
Print 3 - Service

After each filling a comprehensive printer output of the important data occurs automatically.

```
Instr. No.      0
B1 No.          10
Q  29.9976 l
Qt 30.0000 l
Error -0.011 %
Qo 0.0416 l
Qoc -0.043 l
Ot 2000.0 ms
Cal -1.460 %
Qab 0.0000 l
```

B1 = Batch quanity 1
No. = Number of the fill
Q = Filled quantity
Qa = Set batch quantity
Error = Percent error between Q and Qa
Qo = Measuring overrun quantity
Qoc = Set overrun correction value
Ot = Set overrun time value
Cal = Set calibration value
Qab = Set splash loss amount value

f) Print 4 - Summarize day (Print 4)

Communication
Print 4 - Day

In addition to the three printer protocols a daily protocol can be printed. At the end of the production period the following parameters can be printed out. The print out for each Batch Quantity one after the other can be initiated from the converter keypad. If data from more than one converter is to be included in the print out, the protocolling must occur one after the other. Each converter requires a RS 485 data link.

Instr. No.	0
B1 Quantity	5
Qa 30.0000 l	
Qt 131.005 l	
Underfillings	1
Overfillings	0

B1 = Batch quantity1
B1 = Number of the fill
Qa = Set batch quantity
Qt = Grand totalizer quantity

(in this example a 19 liter underfillings has been registered)

Important

a) The printer protocol names were changed beginning with software revision level A.70.

b) A separate printer is required for each converter when 1 to Print 3 are selected. Additionally each Converter must have a RS 485 data link option.

7.3.29.2 Instrument address

Instr. Address
–

Communication over the data link requires an Instrument Address so that the desired instrument can be addressed. This address can have a maximum of two digits. When a number of instruments are connected in parallel over RS 485 data links each instrument must have a different address.

Possible error messages during data entry

Error no.	Cause
22	Entry > 99

7.3.29.3 Baud rate

Baud rate
1200 Bd

The transmission speed of the data link can be selected in this parameter. The following baud rates are available in this parameter and can be selected by using the Arrow keys:

110, 300, 600, 1200, 2400, 4800, 9600, 14400, and 28800 Baud

7.3.29.4 Printer type

The printer type is selected in this parameter with which the converter is to communicate over the data link. If a wrong type is selected the character set will be incorrect resulting in erroneous print outs.

a) F&P DOCUPRINT Option or Hardware from revision year 2000 not available.

b) Standard (40 Z/Z)

Printer Type
Standard (40 Z/Z)

If any standard printer is connected to the converter data link (min. 40 characters/line and internal memory) then the Printer Type Standard (40 Z/Z) is to be selected.

7.3.29.5 Printer clock

Option or Hardware from revision year 2000 not available.

7.3.30 Submenu function check

Submenu
Function test

The name of this menu was changed beginning with software revision level A.70 from Self Check to Function Test.

The Function Test submenu provides 16 functions with which the instrument can be checked independent of the existing flowrate and contact settings. The converter is Off-line during these tests. The individual test routines can be selected using the Arrow keys. To terminate the funktion test press C/CE.

For the exact procedure see Parameter Overview with Displays in Table format (Section 7.2).

7.3.30.1 Iout

Option or Hardware from revision year 2000 not available.

7.3.30.2 NVRAM 22C12

Function test
NVRAM 22C12

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

7.3.30.3 EPROM 27C512

Function test
EPROM 27C512

Select EPROM 27C512 and press ENTER. The converter automatically tests the EPROM and displays a diagnosis.

7.3.30.4 EEPROM 93C46

Function test
EEPROM 93C46

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

7.3.30.5 Ext. EEPROM 93C46

Function test
Ext. EEPROM 93C46

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

7.3.30.6 Alarm contact

Function test
Alarm contact

Select Alarm Contact and press ENTER. Toggle the Arrow keys to turn the alarm on and off. The operation of the contact can be checked by connecting an ohmmeter across terminals V5 and V6 (39/40 for relay and E9/C9 for optocoupler) as well as with the green LED on a separate relay card if installed.

Important

The unscaled pulse output is present on terminals V5 and V6 when the option combination Data Link and Unscaled Output are installed.

7.3.30.7 System alarm

Function test
System alarm

Select System alarm and press ENTER. Toggle the Arrow keys to turn the alarm on and off. The operation of the contact can be checked by connecting an ohmmeter across terminals V7, V8 and V9.

7.3.30.8 Pre-batch contact

Function test
Pre-batch contact

Select Pre-batch Contact and press ENTER. Toggle the Arrow keys to turn the pre-batch contact on and off. The operation of the contact can be checked by connecting an ohmmeter across terminals P1 and P2 as well as with the red LED on a separate relay card if installed.

7.3.30.9 End contact

Function test
End contact

Select End Contact and press ENTER. Toggle the Arrow keys to turn the end contact on and off. The operation of the contact can be checked by connecting an ohmmeter across terminals P3 and P4 as well as with the red LED on a separate relay card if installed.

7.3.30.10 Switch S206

Function test
Switch S206

Select Switch S206 and press ENTER. The switch condition is shown in the display. By operating the switch the converter will display on or off.

Important

The display does not automatically return to the On-line mode. The Function Test can only be terminated by pressing C/CE.

7.3.30.11 Switch S207

Function test
Switch S207

Select Switch S207 and press ENTER. The switch condition is shown in the display. By operating the switch the converter will display on or off.

Important

The display does not automatically return to the On-line mode. The Function Test can only be terminated by pressing C/CE.

7.3.30.12 External batch quantity selection

Function test
Ext. batch select

Select Ext. Batch Select and press ENTER. The 2nd line of the converter display shows the batch quantity selected from contacts A1, A2 and G2. The check of contacts A1 and A2 by the converter for the batch quantities can also be made when a fixed batch quantity has been selected.

Important

The display does not automatically return to the On-line mode. The Function Test can only be terminated by pressing C/CE.

7.3.30.13 Data link

Function test
Data link

Before initiating the test the transmitter and receiver terminals should be tied together on the terminals strip (T- to R- and T+ to R+). The computer sends 1000 ASCII Code 31 Hex characters and monitors their received characters. On the left side are displayed the number of characters without error which were received. The monitoring of the received characters is terminated after 1000 characters have been transmitted. The converter continues to send the characters until the C/CE key is pressed.

Select Data Link and press ENTER. The data link test proceeds automatically at the baudrate set.

Important

The display does not automatically return to the On-line mode. The Function Test can only be terminated by pressing C/CE.

7.3.30.14 Fout

Function test
Fout

Select Fout and press ENTER and enter the desired frequency value (0 to 13000 Hz) directly. A frequency meter can be used to check the unscaled frequency output at terminals V1 and V2 (59/60 passive optocoupler or 94/95 active transistor).

If a Data link is installed and the option Unscaled Pulse Outputs has been selected, the frequency will appear on terminals V5 and V6 (59/60 passive optocoupler).

Important

The display does not automatically return to the On-line mode. The Function Test can only be terminated by pressing C/CE.

7.3.30.15 Display

Function test
Display

This function is used to check the operation of the display as well as the control of the display elements. Select Display and press ENTER.

The digits 0 to 9 and the letters A to F are displayed in both lines

1234567890ABCDEF
1234567890ABCDEF

7.3.30.16 Start contact

Function test
Start contact

Select Start Contact and press ENTER. The switch condition is displayed in the second line. By operating the external start contact the on and off condition can be simulated and checked (terminals 68 and G2).

The pre-batch and end contacts remain inactive.

Important

The display does not automatically return to the On-line mode. The Function Test can only be terminated by pressing C/CE.

7.3.30.17 Stop contact

Function test
Stop contact

Select Stop Contact and press ENTER. The switch condition is displayed in the second line. By operating the external stop contact the on and off condition can be simulated and checked (terminals 69 and G2).

The pre-batch and end contacts remain inactive.

Important

The display does not automatically return to the On-line mode. The Function Test can only be terminated by pressing C/CE.

7.3.31 Submenu detector empty pipe

Submenu
Detector e. pipe

When the possibility exists that the metering pipe in the primary may empty the detector empty pipe module can be used to recognize this condition. The output signals are then set 0 % or 130 % and an alarm contact actuated. The parameters required to set this option are found in the submenu.

1. Detector on/off
2. Adjust Detector Empty Pipe
3. Threshold

If this option is not installed in the converter the following message is displayed when ENTER is pressed:

Error
Not available

7.3.31.1 Detector On/Off

Detector e. pipe
off

The Arrow keys can be used to turn the detector on and off. If the converter does not send an alarm when the pipe empties, the detector must be adjust for the prevailing conditions.

Important

The adjustment should generally be made after the installation of the system in combination with the actual fluid.

Installation of the primary in a vertical orientation improves the response of the detector.

7.3.31.2 Adjust detector empty pipe

Adjust
Detector e. pipe

In order to determine the threshold of the detector it must first be adjusted with a full pipe at no flow. When these conditions are fulfilled the adjustment is made automatically after ENTER is pressed. When the adjustment with a full pipe has been completed the resultant value (full pipe) will be displayed in the 2nd line as follows:

Adjust
+112

With the potentiometer on the SMD Module Detector Empty Pipe the value is to be adjusted to approx. +100. The value should be recorded for use in the threshold calculation.

Subsequently the pipe should be emptied completely and the displayed value (empty pipe) noted for the threshold calculation.

7.3.31.3 Threshold

Threshold
070

Using the values established in 7.3.31.2 the threshold value can be calculated with the following formula and entered in the converter:

$$\text{Threshold} = \frac{\text{Adj. value full pipe + adj. value empty pipe}}{2}$$

It should be noted that only whole numbers can be entered (round off).

7.3.32 Reset totalizers batch quantities 1, 2, 3, 4

Totalizer 1
reset

After selecting the parameter Totalizer 1 Reset and pressing ENTER all totalizer values (grand totalizer, number of fills, overfillings as well as underfillings) for the particular batch quantity are reset to zero. After the reset operation the converter is returned to the process display. The Arrow keys can be used to access the totalizer reset parameters for batch quantities 2, 3 and 4. All totalizers can be reset even when the Programm Protection is turned ON.

For further information see printer protocols.

7.3.33 Error log

Error log
. . . . .

All errors encountered (0, 1, 2, 3, 5, 7, 8 and 9) are stored in the Error Log. All errors remain in memory until the Error Log is manually reset through a double pressing of ENTER.

If further information about the errors stored is desired the possibility exists, after selecting the parameter Error Log, pressing Enter and paging with the Arrow keys, without recourse to the Instruction Manual, to see the error messages in clear text on the converter display.

The following error messages can be displayed:

.0. =	Empty pipe
.1. =	A/D overload
.2. =	Uref too small
.3. =	Flowrate > 130 %
.5. =	NVRAM loaded
.7. =	Urefp too large
.8. =	Urefn too large
.9. =	Excitation

Error messages, causes and corrective measures

Error messages according to priority

Error No.	Clear text / Warning	Error cause	Corrective measures
5	NVRAM loaded	Reinitialization of the NVRAM with data from EEPROM during operation	For repeated error occurences exchange converter; check defective transformer (see converter test), recalibrate or return to factory).
9	EXICITATION	Faulty excitation	Check wiring, check if primary contains a preamplifier (bridge 7 + 8). Check signal cable for shorts. Check supply power.
0	EMPTY PIPE	Pipe line not full	Fill pipe line. Adjust detector empty pipe. Check installation.
7	REFp TOO HIGH	Positive reference voltage too high	Select correct primary in converter. Check supply voltage, supply frequency and installation.
8	REFn TOO HIGH	Negative reference voltage too high	
2	REF TOO LOW	Pos. or neg. Ref. too low	Check installation (signal cable). Place switch S901 in proper setting. Measure reference voltage at primary (3 to 16). Check interconnection wiring.
1	A/D OVERLOAD	A/D converter overload	Check grounding, installation, supply power, reference voltage. Fill pipe line.
3	FLOW RATE > 130 %	Flow rate greater than 130 %	Increase range, reduce flow rate, check if pipe line is full.

Error log
0 . . 3 . . . . .

In the following example error 0 (Empty pipe) and error 3 (flowrate > 130 %) have been encountared since the last reset.

Important

In the Error Log the errors with the highest priority are displayed and stored. When an error occurs, the metering is immediately terminated. Only after the error is corrected can operation be resumed.

Exception:

When the flowrate exceeds 130 % of the Range error 3 is displayed. If the flowrate decreases below this value the error message is automatically reset.

When the flowrate exceeds 130 % a filling error (overfilling) generally occurs because the meter does not measure any flowrates which are > 130 %.

When a number of digits are displayed each individual digit refers to an error code. The first character displayed is the error code for the error with the highest priority.

Display of error code 5 does not signify a defective EEPROM but indicates that a reinitiallization of the NVRAM has occurred and that the data stored in the EEPROM has been loaded during operation.

7.3.34 System alarm log

System alarm log
. . . . .

All errors encountered (A, B, C, D, E, F and G) are stored in the System Alarm Log. All errors remained in memory until the log is manually reset through a double pressing of ENTER.

If further information about the errors stored is desired the possibility exists, after selecting the parameter System Alarm Log, pressing ENTER and paging with Arrow keys, without recourse to the Instruction Manual, to see the error messages in clear text on the converter display.

The following error messages can be displayed:

.A. = Max. fill time
.B. = Flow > SMG +5 %
.C. = Auto. zero > 5 %
.D. = Overfilling
.E. = Underfilling
.F. = Power loss
.G. = Pulse calculation

Error No.	Clear text / Warning	Error cause	Corrective measures
D	Overfilling	The last fill is greater than the allowable tolerance.	Check the pressure, level control and supply pump, may cause large flow variatios. Value sticking. Changing product density when checking with scale. Check calibration factor. Check overrun.
E	Underfilling	The last fill is less than the allowable tolerance.	See measure under overfilling. Fill stopped by ext. stop or max. fill time (check system and control).
A	Max. fill time	The max. fill time (configurable) was exceeded and the fill process stopped.	The flowrate was decreased (supply). The value did not open or completely open. Product properties have changed (viscosity).
C	Auto. zero. > 5 %	The zero can no longer be automatically adjusted because its value is > 5 % of the range.	The flow did not reach zero after the overrun time; value not completely closed, a leak has occured, strong pulsations in the pipe line.
B	Flow > SMG + 5%	A flowrate > 5 % plus (low flow cut-off value) was measured during the off time.	The fluid did not return to zero flow rate after completion of the fill cycle; value not completely closed, a leak has occured, strong pulsation in the pipe line.
F	Power loss	Display dark, operate LED off.	Check cabling, supply voltage and fuses.
G	Pulse calculation	The sum of the correction quantities (overrun plus splash loss) is greater than the batch quantity.	Increase batch quantity. Decrease overrun or splash loss quantities or enter a fixed overrun quantity.

System alarm log
A . . . E . .

In the following example error A (Max. fill time) and error E (Underfilling) have been encountered since the last reset.

Important

In the System Alarm Log the error, which based on the priority are lower than those in the Error Log are displaed and stored. After such an error has occurred, it will be reset by the next Start pulse since the causes are usually short time effects.

If the error continues to occur measures should be instituted to eliminate the cause.

7.3.35 Batch Start and Stop

Batch
Start

With this control function the fill process can be started from the converter keypad and stopped during a fill cycle regardless of the programmed control.

Select the parameter Batch Start and when ENTER is pressed the fill cycle is started and the pre-batch and end contacts set.

Batch
Stop

After selecting the parameter Batch Stop during a fill cycle and pressing ENTER the cycle will be interrupted. Pre-batch and end contacts will be actuated, the overrun measurement is made (when selected) and the fill will be checked against the tolerance limits.

Important

Interrupted, incorrect measurements will not be included in the mean value calculation.

7.3.36 Load data from external EEPROM

Load data from
ext. EEPROM

If the converter data after start up and system optimization were stored in the external EEPROM (see Load Data in External EEPROM) this command can be used to load the converter data set into a converter. This function is especially useful if a converter has to be exchanged or when converter data is changed during further system optimization and it is determined that the last data set stored is the optimal set. There by data loss is eliminated and a quick converter exchanged without extended down times is assured.

7.3.37 Store data in external EEPROM

Store data in
ext. EEPROM

This function can be used after start up and system optimization to store parameter settings in an external EEPROM installed on the converter base plate. This provides the possibility to safeguard the extensive data set of the converter and to load the data set info another converter after an exchange has been made (see Load Data from External EEPROM).

Automatic return to the Online display after the storing process is completed or by pressing C/CE.

Important

When parameters are changed they are not automatically stored. When a new or optimized data set is to be stored the parameter Store Data in External EEPROM must be selected and ENTER pressed. The totalizer values are not stored in the external EEPROM.

7.3.38 Software version

50ES7000 06/98
D699B074U01A.75

This display is only informational and the values cannot be changed. When contacting the Service Department this information should be available.

The meaning of the Values in the display are as follows:

50ES7000	ABB Converter model number
06/98	Date of the last software revision
A.75	Software revisions level
D699B074U01	ABB EPROM Part Number

7.3.39 Code number

Code number

ABB Service personnel can access additional internal parameters settings by entering the proper code number. The calibrations constants of the converter are located in this region. Changing of these parameters would invalidate the calibration requiring a recalibration.

The converter can also be reinitialized after the proper code number has been entered. This also erases the data stored in the external EEPROM and resets it to the default values.

A return to the process display occurs when an incorrect Code number is entered or the power is turned off and back on again.

Important

When required the Code Number can be obtained by contacting ABB. We would indicate that any damage and costs resulting from use of this Code Number are not the responsibility of ABB.

8 Overview of in- and outputs with functions and output signals

8.1 Input contats

a) **Start contact (terminals 68/G2)**
The start contact can be actuated from the keypad, an external contact, SPC, PC or PCS. The user must supply the 24 V dc power.

b) **Stop contact (terminals 69/G2)**
The stop contact can be actuated from the keypad, an external contact, SPC, PC or PCS. The user must supply the 24 V dc power.

c) **External batch quantity selection (terminals A1/A2/G2)**
The batch quantity selection can be made from the keypad, wall switch, container size detector, SPC, PC or PCS. The user must supply the 24 V dc power.

d) **External zero adjust (terminals 68/69/G2)**
The stop and start contacts are used together for the external zero adjust selection. The contacts can be actuated from a SPC, PC or PCS where by the order and pulse period must be observed. The user must supply the 24 V dc power.

8.2 Outputs contacts

a) **Pre-batch contact (terminals P1/P2)**
After the pre-batch quantity set is reached the pre-batch contact is actuated. It can be used to utilize a 2-stage fill procedure. The user must supply the 24 V dc power.

b) **End contact (terminals P3/P4)**
After the batch quantity set is reached the end contact is actuated. The user must supply the 24 V dc power.

c) **Alarm contact (terminals 39/40 or terminals E9/C9)**
Errors 0, 1, 2, 3, 5, 7, 8 and 9 are signalled over the alarm contact. In addition to actuating the contact, the current and unscaled pulse outputs are set to 0 % or 130 %. The alarm remains active as long as the error condition exists and fill cycle cannot be started. The user must supply the 24 V dc power.

d) **System alarm contact (terminals V7/V8/V9)**
Errors A, B, C, D, E, F and G are signalled over the system alarm contact. In addition to actuating the contact, the current and unscaled pulse outputs are set to 0 % or 130 %. The alarm is reset when the next start pulse is issued. The user must supply the 24 V dc power.

8.3 Output signals

a) **Data link (terminals R-/R+/T-/T+, RS 485)**
Available is the data link RS 485 and the data link communication protocols ASCII and µDCI. Communication is possible with printer, Remote Operator Unit (ROU), PC, SPC and PCS.

b) **Unscaled pulse output (terminals 59/60 or 94/95)**
The unscaled pulse output is a flowrate proportional 0–10 kHz frequency output (Q = 100 % = 10 kHz). Used in combination with the pulse factor it provides a means to produce a fill curve. Available as a passive optocoupler.

Important

For additional information and connection examples, contact settings and input signal levels see Section “Interconnection Diagrams” and Section 4.7 “Interconnection diagram for Peripheral Instruments”.

9 Application and sizing information for filling and dosing systems

There follow a number of points to consider regarding sizing and layout of the fill and dosing system as well characteristic values for setting the parameters.

- **Conductivity**
  of the product should be checked and the appropriate instrument design selected (Minimum conductivity 20, 5 or 0.5 µS/cm).
- **Sizing of the supply tank**
  The supply tank should be sized so that it can hold at least 5 to 10 times the volume required for one fill cycle. This volume should occupy 60–70 % of the total supply tank volume. The remaining 30–40 % of the volume is reseved for a carbon dioxide or sterilized air pad for pressure and level as well as for flow velocity (Q_{max}) control.
- **Valve**
  When possible use a 2-stage valve, otherwise a 1-stage valve. A determining factor for reproducible fillings is a **reproducible closing characteristic** of the valve. The valve closing time overrun quantity should not exceed approx. 30 % of the fill quantity.
- **In- and outlet sections**
  should be maintained. Elbows upstream of the meter are to avoided.
- **When possible use rigid piping**
  If hose connections are necessary because of vibration conditions, use reinforced pressure hoses to minimize pump effects.
- **All cables and leads**
  are to be shielded with grounded shields. Additionally the primary and converter must be properly grounded.
- **Constant volume flowrate**
  Especially necessary when the batch quantity is reached and the end contact actuated. Can be achieved by pressure and level control in the supply tank or by using speed controlled pumps from the reservoir.
- **Single stage filling**
  For fill time < 2–3 seconds and small bayonet filling < 200 ml.
- **Two stage filling**
  For fill time > 2–3 seconds and batch quantities > 200 ml.

A highly reproducible fill can be achieved with a single stage process for longer fill times and large batch quantities if the boundary conditions remain constant.

- **Overrun measurement**
  Usually used for fill times > 1 second. If for system technical reasons (fill frequency, pulsation in the pipe line, entrained air, etc.) the automatic overrun measurement must be turned off, a constant overrun correction factor, an external correction factor or a correction to the batch quantity can be utilized.
- **Automatic zero adjustment**
  Usually turned on when fill frequency and the boundary conditions permit. If for system technical reasons (fill frequency, pulsation in the pipe line, entrained air, etc.) the automatic zero adjustment must be turned off, a constant zero or external zero adjustment procedure can be utilized.
- **Data security of the parameters for CIP cleaning**
  The Fill-MAG may not be started during the CIP cleaning cycle or when the pipe is empty in order to prevent the loss of the parameter data for the product fill.

  The Fill-MAG should be turned off at the end of the production period after a successfull fill or prior to the next fill if it is not expected to be completed. For draining and filling of the pipe line the valves must be externally controlled (open/close)!
- **When checking volumetrically filled containers with a weigh scale the density of the product and the various densities of solids (e.g fruit in yogurt) contained in the product as well as the variable weights of the containers must be considered.**

10 Start Up information

10.1 Checking the metering system

Warning

When the housing lid has been removed and the power turned on it is possible to come in contact with live elements.

- **Is the primary installed in the correct location?**

  Check permissible installation conditions (Pg screw-type conduit fittings point downward even when the flow direction does not correspond to the flow arrow, temperature).

- **Is the converter installed in the correct location?**

  Check permissible installation conditions (RFI level. shielded leads, cable routing, max. cable length, protection class, temperature, vibration).

- Is the wiring in accordance with the interconnection diagrams?
- Is the primary grounding correct?
- Is the supply voltage (±10 %) and the line frequency (±6 %) in agreement with the values listed on the converter name tag?
- Is the primary filled with fluid?
- Turn power on. Is the display lit and does the process display appear?
- Are the parameters Batch and Pre-batch Quantities, Overrun Correction Quantity, Meter Size, Units, Range, etc. set correctly?
- Has the system zero been adjusted under operating conditions?

Important

If the actual flow direction does not correspond to the direction indicated by the flow arrow on the primary, the following measures can be followed. This are necessary since the contact outputs are not operational in the reverse flow direction.

Measures:

a) For standard primaries the signal leads and their shields (only at the primary end of the cable) are to be exchanged.
Terminal 1 with terminal 2
Terminal 1S with terminal 2S

b) For primaries with preamplifiers only terminals 1 and 2 may be exchanged (only at the primary end of the cable), because the terminals U+ and U- are used for the preamplifier supply power of ±12 V.

10.2 Start Up procedure

- Turn program protection off.
- Select the meter size.
- Select the range unit.
- Select the batch mode (in batch selection select batch 1–4 or external).
- Enter Pre-batch and overrun quantities.
- Enter the overrun time (> max. valve closure time + safety factor) and the mean value correction factor (3 at start up, 3 to 5 for normal operation).
- Set Range (the max. flowrate in standard applications should occur at 70 to 100 % of the Range value).
- Fill and bleed the pipe line up to the fill valve or fill head.
- Adjust system zero with product in the line.

- Conditions for adjusting zero: full pipe line zero flow.
- The flowrate indication should be 0 % after the adjustment has been completed.
- Turn on automatic zero adjust when possible.
- **Optimizing the system**
  Determine the calibration factor a series of approx. 10 measurements (the Calibration Factor can be approximated by the average of the deviations expressed as a percentage of the batch quantity, see Section 7.3.12). Enter this approximate value and repeat this procedure until the system is accurately optimized.
  If underfillings occur enter a PLUS Calibration Factor; if overfillings occur enter a MINUS Calibration Factor.

An additional method for optimizing the system is to apply the correction to the Batch Quantity. Dependent upon whether under- or overfillings occur the Batch Quantity can be increased or decreased. It should be noted however that the fil statistics will no longer be correct.

Important

After the Parameters have been changed, at least 10 fillings should be made before the next set of measurements are made to check the validity of the new settings.

The filling and dosing cycles should now function satisfactorily provided that the correct system and boundary conditions (pressure and level control, valve closing time, etc) exist. Subsequently a further optimization of the system and parameter settings can be made from the monitoring functions (over and under fillings limits), the safety functions (max. Fill Time, Code Number) and the options (data link, current output, detector empty pipe).

Safeguarding parameter data

When the setting of the meter and the system have been optimized, the parameter data from the converter should be stored in the external EEPROM with the function Store Data in Ext. EEPROM.

Thereby a quick converter exchanged can be accomplished by loading this stored data set into the new converter. After zero adjustment of the new converter has been completed operation can be resumed.

Important

The Fill-MAG may not be started when the pipe contains air or during the CIP cleaning cycle otherwise the settings for operating parameters such as Overrun Quantity, Overrun Correction, System Zero, etc. may be changed. A specific number (based upon the Mean Value Correction setting) of fillings with product must be run before the values in the converter return to their correct settings.

Important

The system zero must usually be readjusted when elements of the meter are replaced. It is also recommended that the zero be readjusted when the product is changed.

10.3 Possible errors and their causes

Metering system does not operate

a) Check supply power.

b) Check fuses in converter.

Reproducible measurement results not achieved

a) Check agreement between primary and meter size selected.

b) Check range setting.

c) Check all parameters required for operation.

d) Check the overrun quantity.

Underfillings

a) Metering system not optimized.

b) Metering system forced to shut down.
   – Maximum fill time set too short.
   – External stop signal from system.
   – External stop from Emergency Stop button.

c) Large flowrate variations when the end contact is actuated and the overrun measurements are being made.

d) Large variations in valve closure time.

e) Zero variations during the cycle (RFI).

f) Air entrained in fluid.
For homogeneous ditribution (foamed products) this effect is desired and presents no problem.

g) Varying solids content in the fluid.

h) Insufficient fluid conductivity.

i) Backflow during fill cycle and Forward Only selected for flow totalization.

j) After changing product due to changes in the product properties causing changes in the overrun quantity, calibration and system zero.

k) During overrun correction and system zero adjust pulsation or air is present, in the pipe line or measurements with fluids other than product in the pipe line (e.g cleaning solution or water after CIP cleaning).

l) Due to system material loss or leak.

m) Checking with a scale requires consideration of product density.

Overfillings

a) See points a, c, d, e, g, h, j, k and m under Underfillings.

b) The overrun time was set too short. This results in a constant overfilling of the container which is not measured or corrected by the converter.

Converter indicates reference voltage error

a) Cabling error (conductor interchanged, short between conductor and shield).

b) Jumpers on the connection (19”) or base board set incorrectly (Br 1 and 2 for standard primaries or Br 7 and 8 for primaries with preamplifiers).

c) Interruption of the excitation current (M1 and M3).

11 Checking and maintenance of the converter 50ES7000

Warning

There are electrostatic sensistive parts on the circuit boards (observe EGB-Guidelines)

11.1 Test instruments required

- Simulator Model 55XC4000

11.2 Testing the converter with the Flowmeter Primary Simulator 55XC4000

The test procedure is described in the Flowmeter Primary Simulator Instruction Bulletin. Part No. D184B049U02. Only trained personnel should conduct the tests.

11.2.1 Maintenance Converter

The converter is maintenance free.

Important

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

Important

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

11.3 Maintenance Primary / Converter

The flowsystem is essentially maintenance free. A yearly check should be made of the ambient conditions (air flow, humidity), seal integrity of process connections, cable entry, lid screws, functional safety of the supply power, lightning protection and ground connections.

The electrodes in the primary should be cleaned when the measured flowrate and the converter flowrate indication no longer correspond. Higher indications signify the presence of an insulating coating while lower indications signify the presence of a shorting coating.

11.4 Block diagram and circuit boards

11.4.1 Block diagram Fill-MAG converter 50ES7000

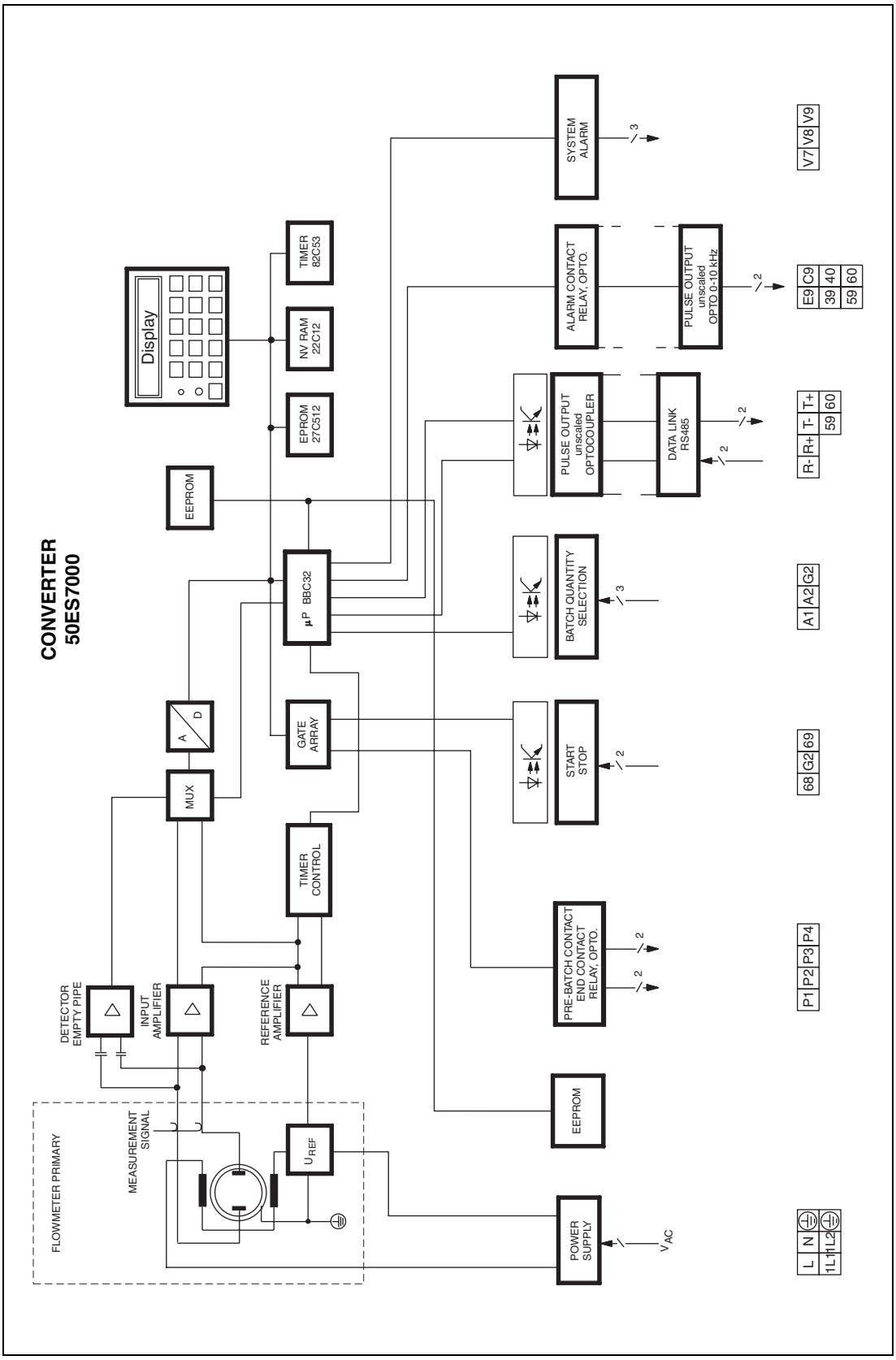


Abb. 12: Block diagram Fill-MAG converter 50ES7000

11.4.2 Connection board 19” converter module (21 TE), optocoupler output

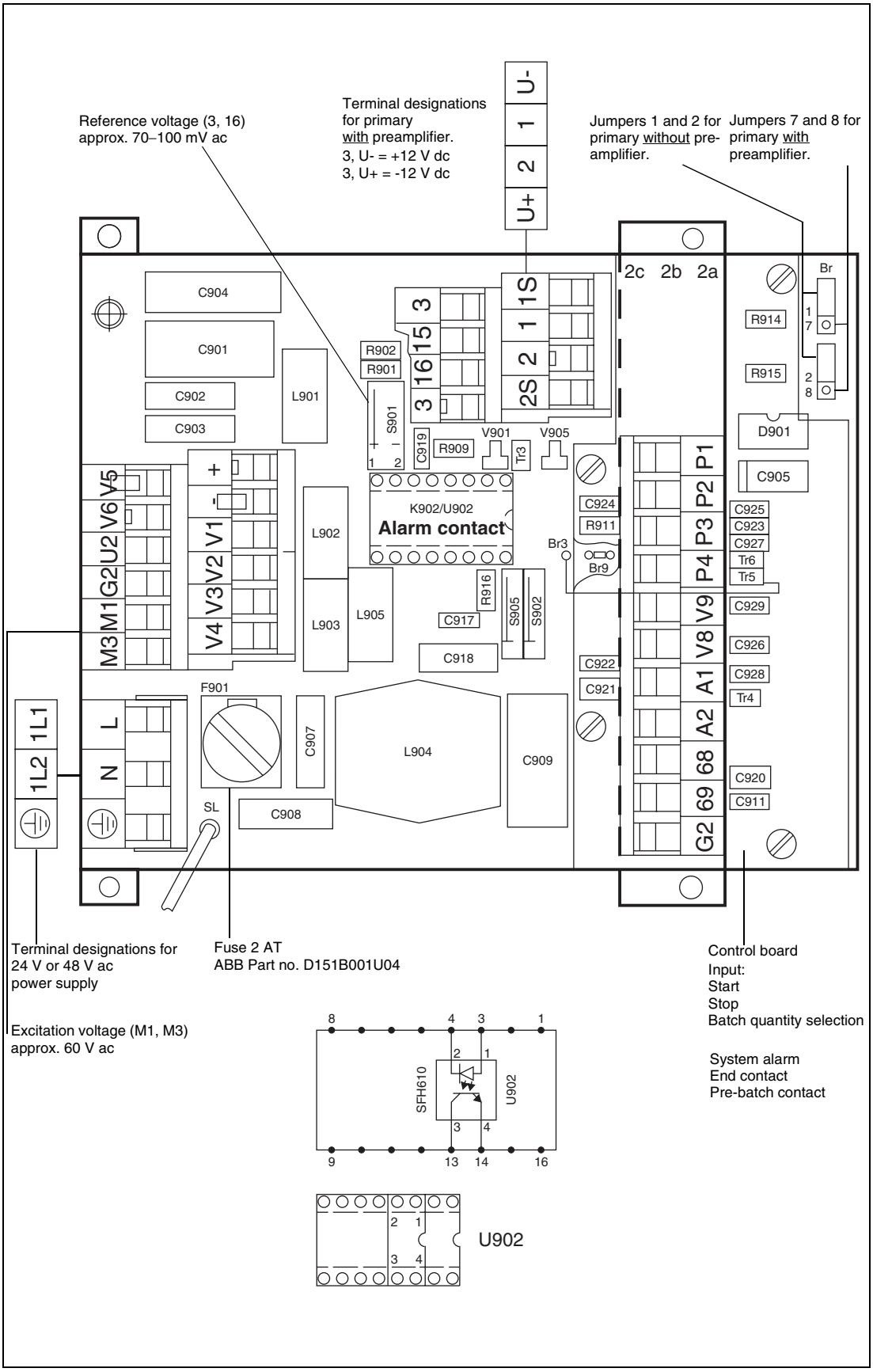
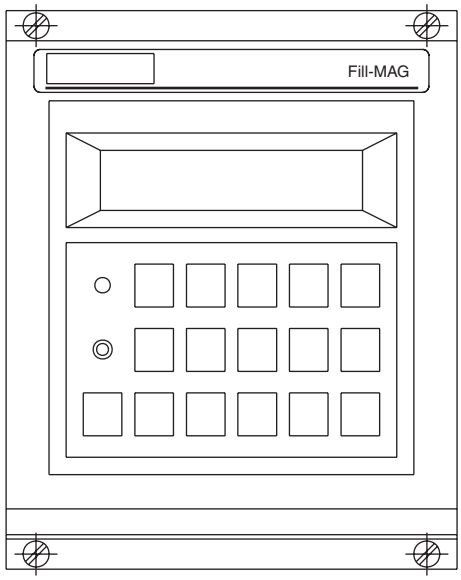
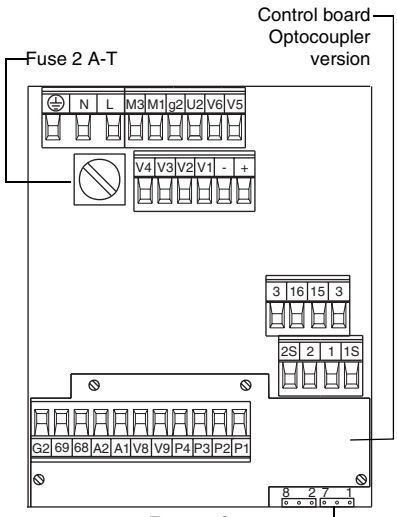


Abb. 13: Connection board 19” converter insert (21 TE), optocoupler output



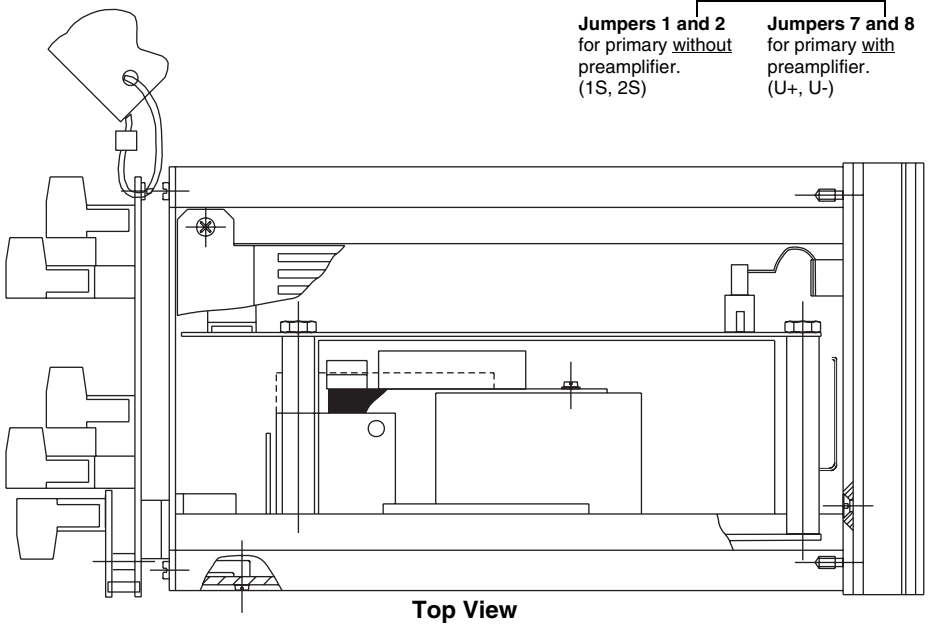
Front View



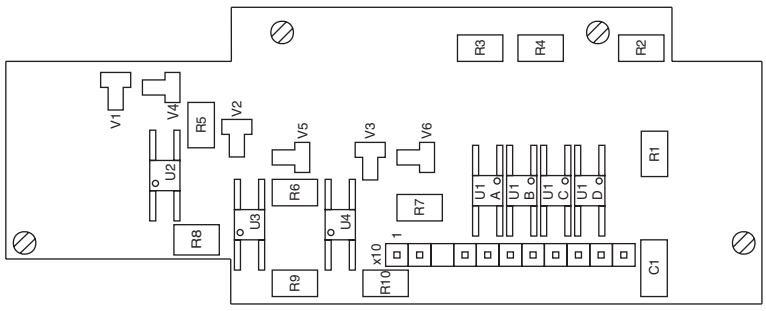
Rear view
Connection site optocoupler

Jumpers 1 and 2 for primary without preamplifier. (1S, 2S)

Jumpers 7 and 8 for primary with preamplifier. (U+, U-)



Top View



Control board

Abb. 14:

11.4.3 Connection board 19" converter module (28 TE), relay output

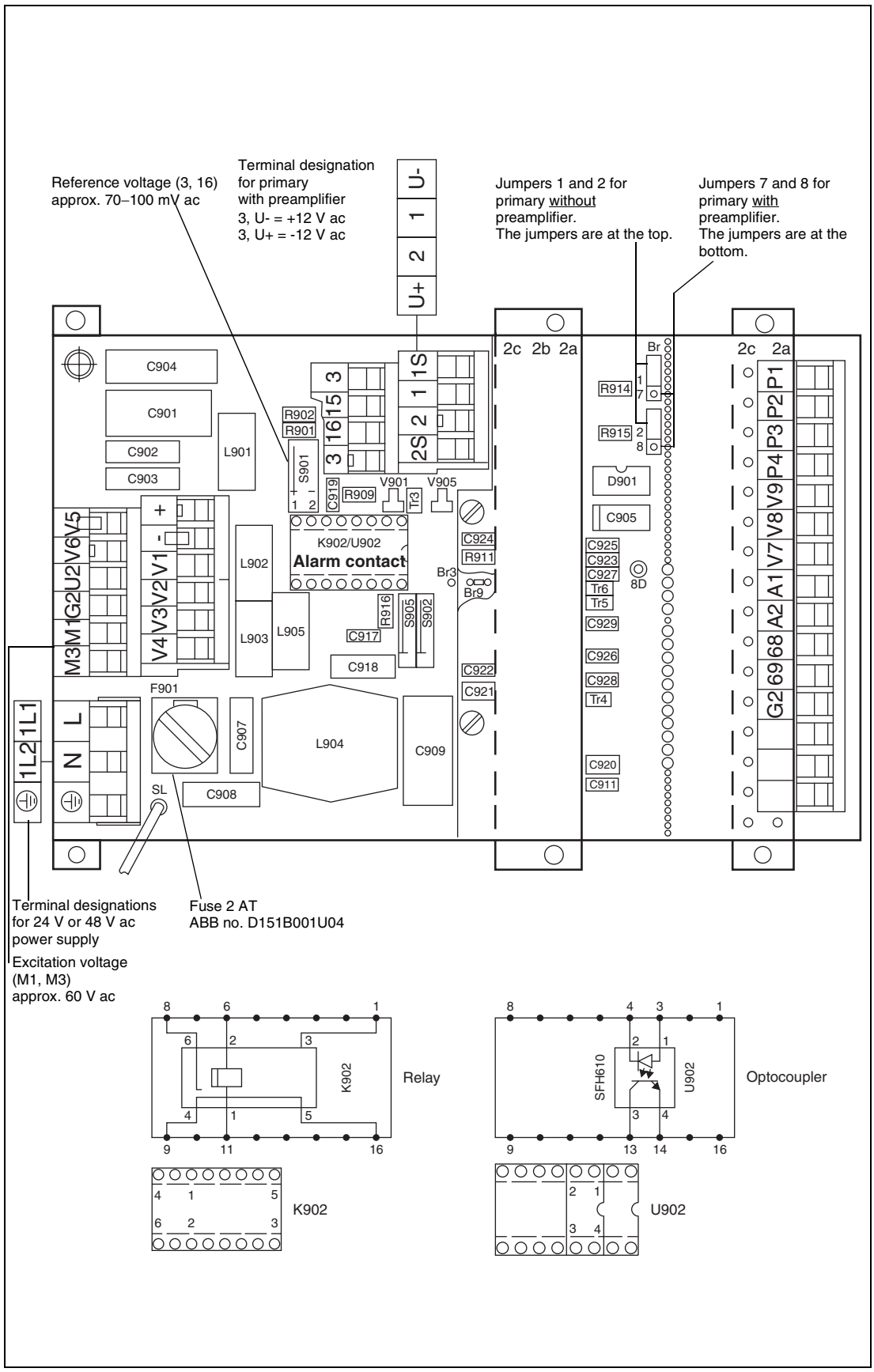


Abb. 15: Connection board 19" converter insert (28 TE), relay output

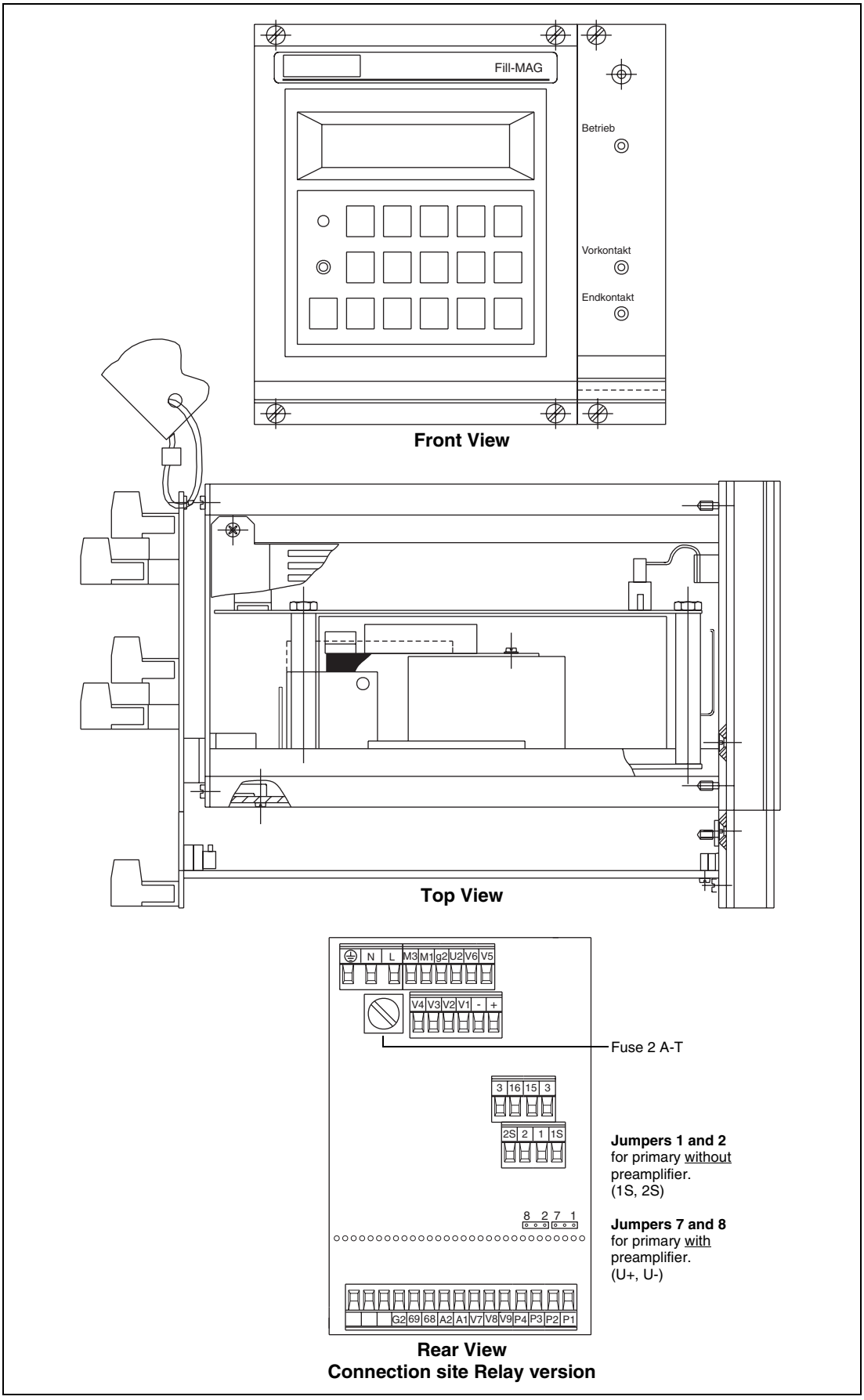


Abb. 16: Fill-MAG, 19” design, relay output

11.4.4 Connection board field mount housing

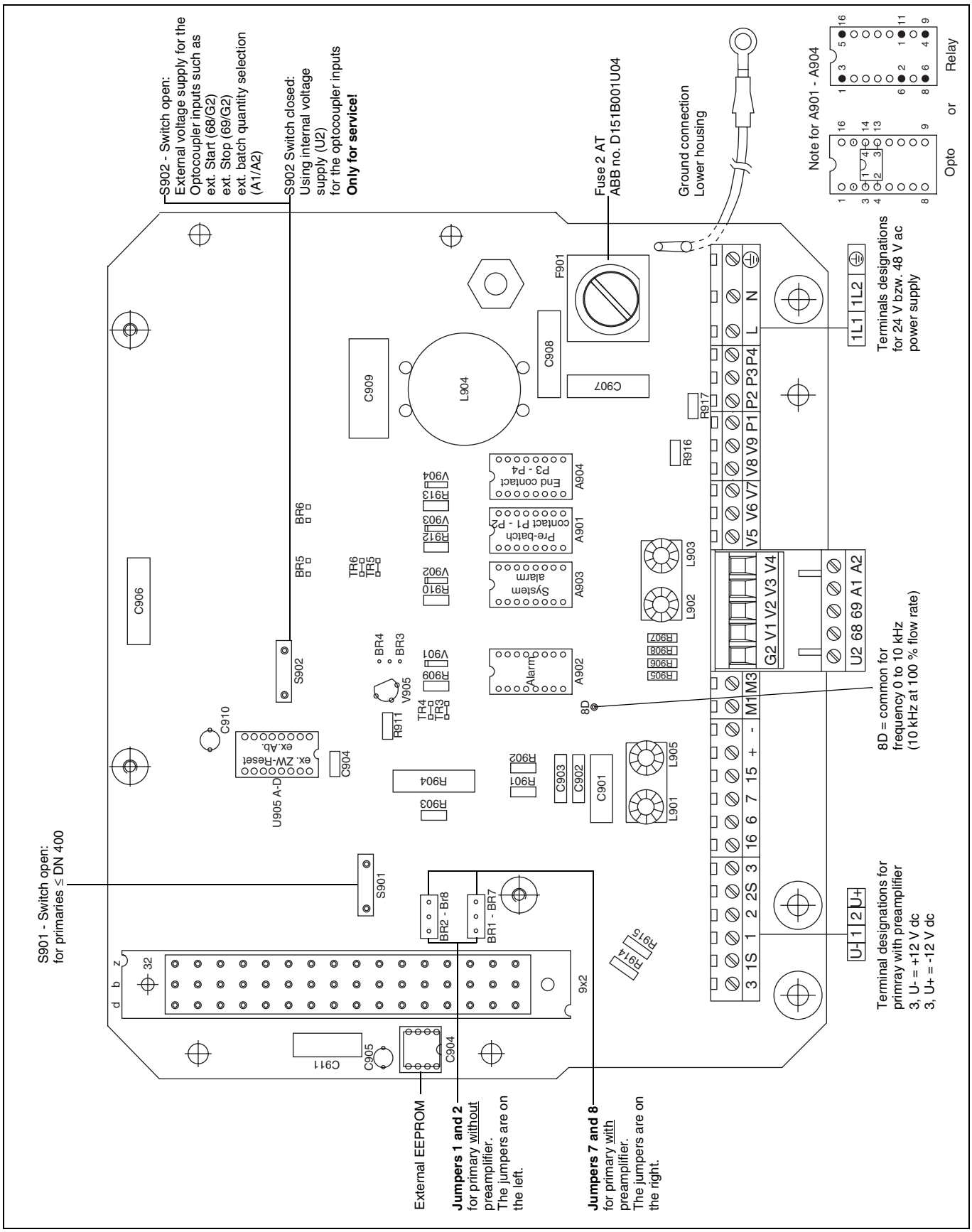
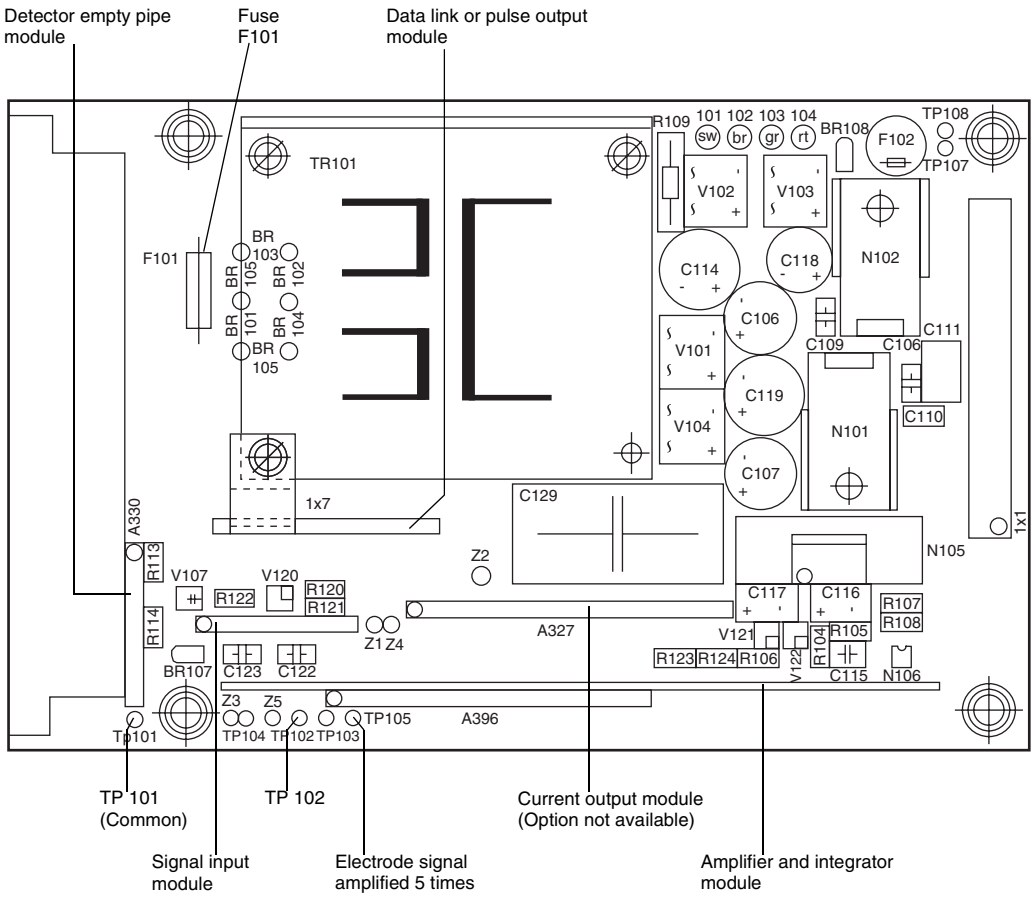


Abb. 17: Connection board field mount housing

11.4.5 Analog board 19” module and field mount housing



AC	Br. 101	Br. 102	Br. 103	Br. 104	Br. 105	Br. 106	F101	Fuse F101 ABB Part no.
230 / (240) V	×						0.160 A-T	D151B001U09
(220) V		×					0.160 A-T	D151B001U09
115 / (120) V					×	×	0.315 A-T	D151B001U01
(110) V			×	×			0.315 A-T	D151B001U01
(48) V	×						0.8 A-T	D151B001U14
24 V					×	×	1.6 A-T	D151B001U18

Abb. 18: Analog board Fill-MAG with jumper combinations for power supply and fuse values

11.4.6 Digital board 19” module and field mount housing

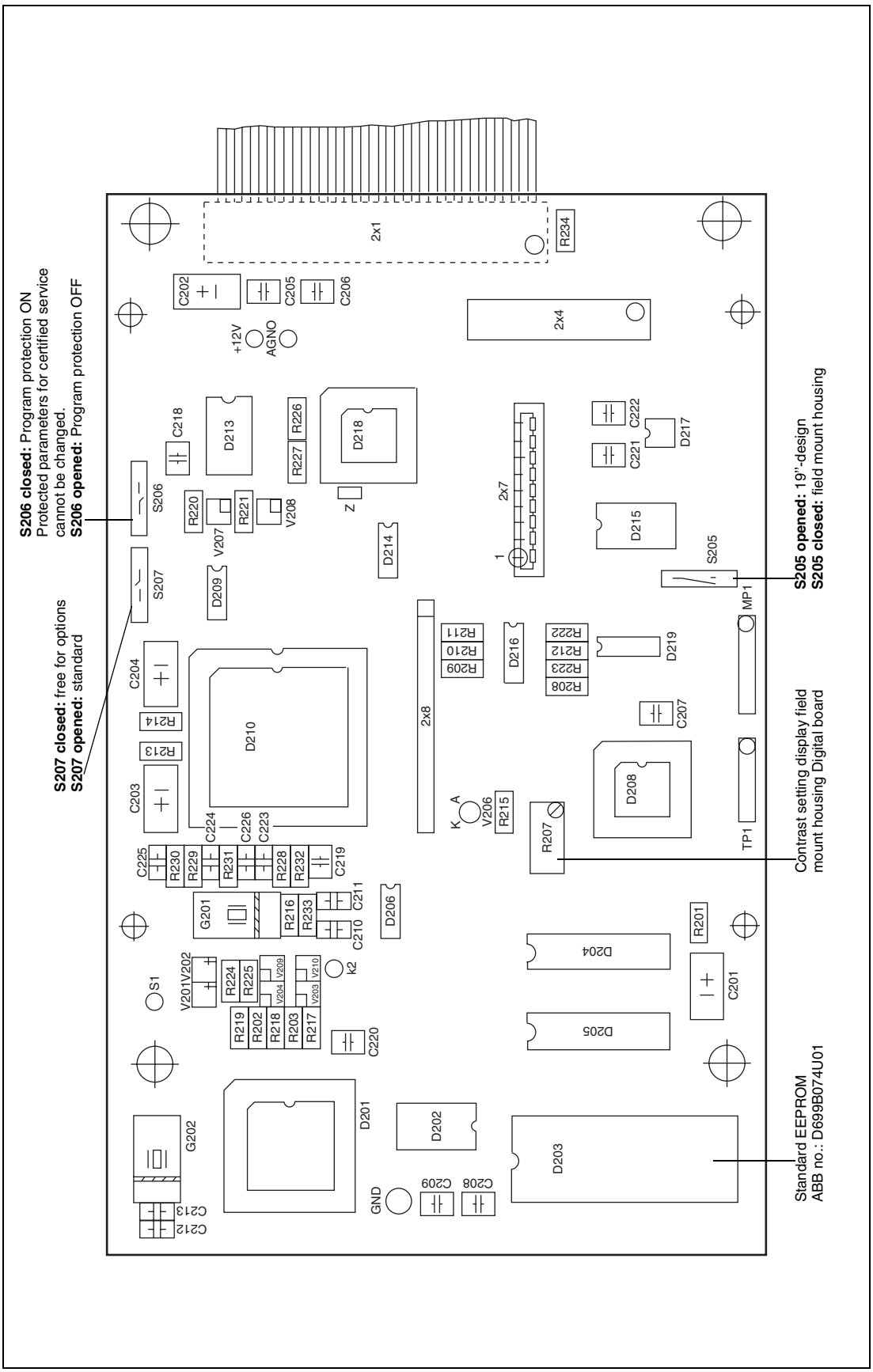


Abb. 19: Digital board Fill-MAG converter

11.4.7 Control card 19” module

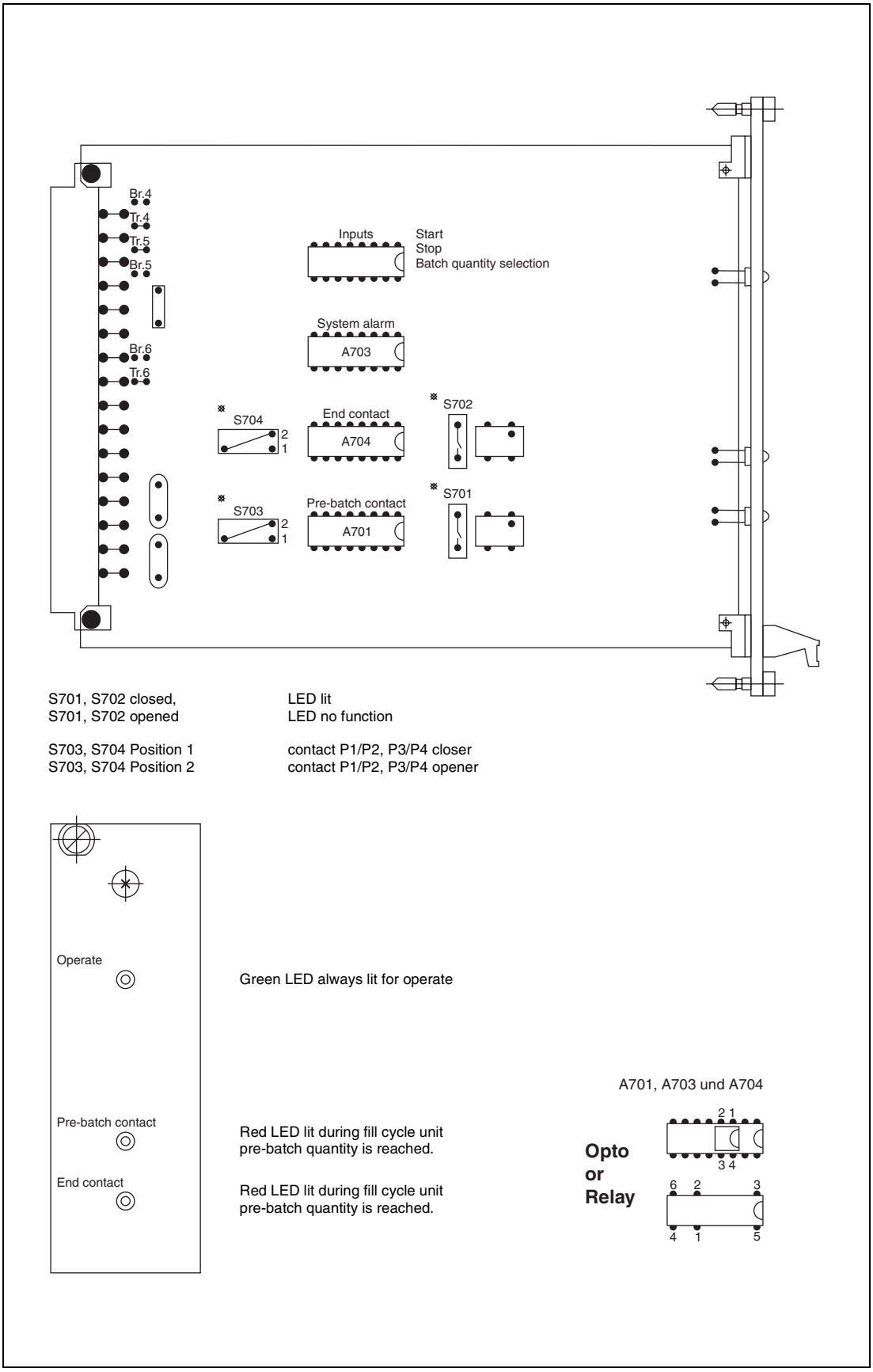


Abb. 20: Control card Fill-MAG converter with switch functions

11.4.8 Layouts for option board

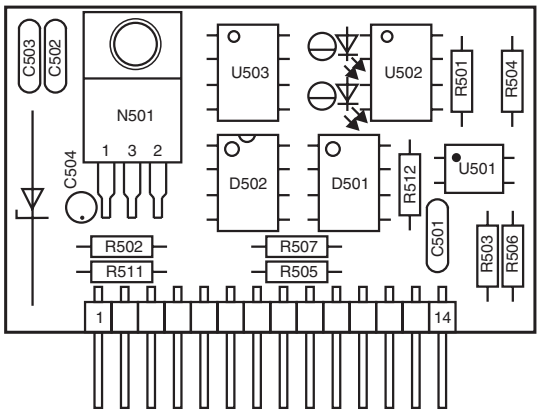


Abb. 21: Serial data link RS 485 (RS 422), part no. D685A299U01

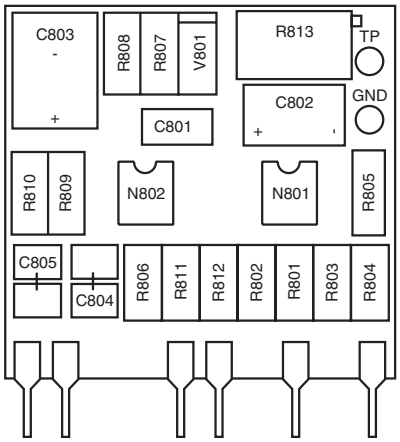


Abb. 22: Detector empty pipe module, part no. D685A330U01

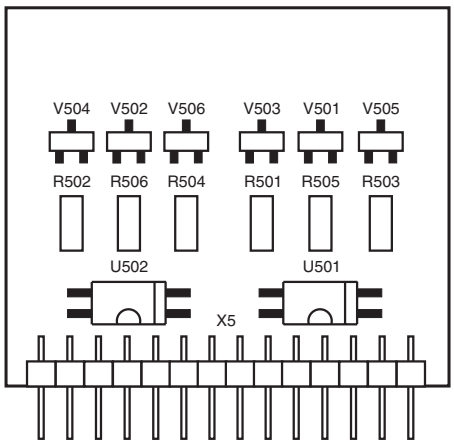


Abb. 23: Pulse amplifier module optocoupler, part no. D685A606U02

11.5 Spare parts

11.5.1 Spare parts converter

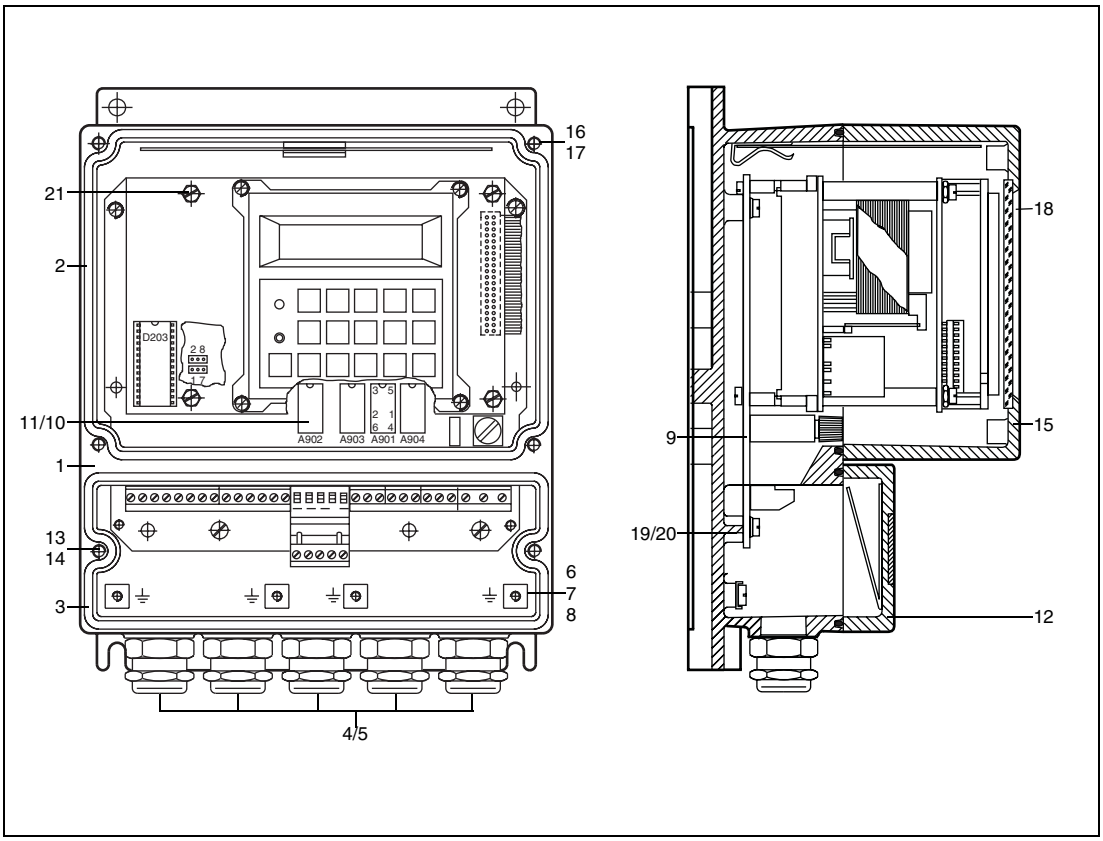


Abb. 24:

No.	Description	Part no.
9 10 11	Connection board Design with relay Design with optocoupler	D685A583U06 D163B013U01 D177B099U17
22 23 24	Fill-MAG EEPROM Optocoupler (output) Relay (output)	D699B074U01 D177B009U17 D163B013U01
25	Connections board, 19'', relay (with separate control card, 28 TE)	D685A494U02
26 27 28 29	Connections board, 19'', optocoupler (with separate control card, 28 TE) Control card optocoupler (for 19'' converter, 21 TE, Opto) Control card Fill-MAG, relay Control card Fill-MAG, optocoupler	D685A494U03 D685A493U02 D674A356U03 D674A356U02

12 Technical data converter 50ES7000

12.1 Flow range

The flow range can be set continuously from 0.5 m/s to 10 m/s and short term excursions to 130 % of Range will be measured.

Flow range, meter size and pressure rating

Meter size DN	in	Std. press. rating PN variable	Std. press. rating PN wafer	Std. press. rating PN Flange	min. Flow range flow velocity 0 to 0.5 m/s	max. flow range flow velocity 0 to 10 m/s	effective fluid velocity flow velocity 10 m/s / PTFE / PFA Model DS21	10DS3111
1	1/25	10	–	–	0 to 0.03 l/min	0 to 0.6 l/min	10.61 m/s	–
1.5	1/17	10	–	–	0 to 0.05 l/min	0 to 1.0 l/min	9.43 m/s	–
2	1/12	10	–	–	0 to 0.1 l/min	0 to 2.0 l/min	10.61 m/s	–
3	1/8	10	40	40	0 to 0.2 l/min	0 to 4 l/min	9.43 m/s	9.43 m/s
4	5/32	10	40	40	0 to 0.4 l/min	0 to 8 l/min	10.61 m/s	10.61 m/s
6	1/4	10	40	40	0 to 1 l/min	0 to 20 l/min	11.79 m/s	10.05 m/s
8	5/16	10	40	40	0 to 1.5 l/min	0 to 30 l/min	9.95 m/s	9.95 m/s
10	3/8	10	40	40	0 to 2.25 l/min	0 to 45 l/min	9.95 m/s	7.89 m/s
15	1/2	10	40	40	0 to 5 l/min	0 to 100 l/min	12.55 m/s	10.38 m/s
20	3/4	10	40	40	0 to 7.5 l/min	0 to 150 l/min	9.82 m/s	8.55 m/s
25	1	10	40	40	0 to 10 l/min	0 to 200 l/min	7.37 m/s	6.53 m/s
32	1 1/4	10	40	40	0 to 20 l/min	0 to 400 l/min	9.43 m/s	7.26 m/s
40	1 1/2	10	40	40	0 to 30 l/min	0 to 600 l/min	9.82 m/s	7.92 m/s
50	2	10	40	40	0 to 3 m³/h	0 to 60 m³/h	9.61 m/s	8.00 m/s
65	2 1/2	10	16	40	0 to 6 m³/h	0 to 120 m³/h	11.04 m/s	9.54 m/s
80	3	10	16	40	0 to 9 m³/h	0 to 180 m³/h	11.63 m/s	10.64 m/s
100	4	10	10	16	0 to 12 m³/h	0 to 240 m³/h	9.21 m/s	8.14 m/s
125	5	–	–	16	0 to 21 m³/h	0 to 420 m³/h	–	9.40 m/s
150	6	–	–	16	0 to 30 m³/h	0 to 600 m³/h	–	9.15 m/s
200	8	–	–	10/16	0 to 54 m³/h	0 to 1080 m³/h	–	9.64 m/s
250	10	–	–	10/16	0 to 90 m³/h	0 to 1800 m³/h	–	9.95 m/s
300	12	–	–	10/16	0 to 120 m³/h	0 to 2400 m³/h	–	9.34 m/s
350	14	–	–	10/16	0 to 165 m³/h	0 to 3300 m³/h	–	10.49 m/s
400	16	–	–	10/16	0 to 225 m³/h	0 to 4500 m³/h	–	10.79 m/s

Meter sizes table

12.2 Reference conditions per DIN EN 29104

Fluid temperature
20 °C ±2 K

Ambient temperature
20 °C ±2 K

Power supply
Voltage per name tag U_N ±1 %

Straight pipe installation requirements
Upstream > 10xDN,
Dowmstream > 5xDN,
DN = Meter size primary

Warm up time
30 Min

Reproducibility
±0.2 % of rate. (Standard deviation)
The continuous overrun correction, under reference conditions and homogen products, makes possible a filling reproducibility of < ±0.2 % of rate in place of the system / instrument accuracy specification (±1.0 % of rate).

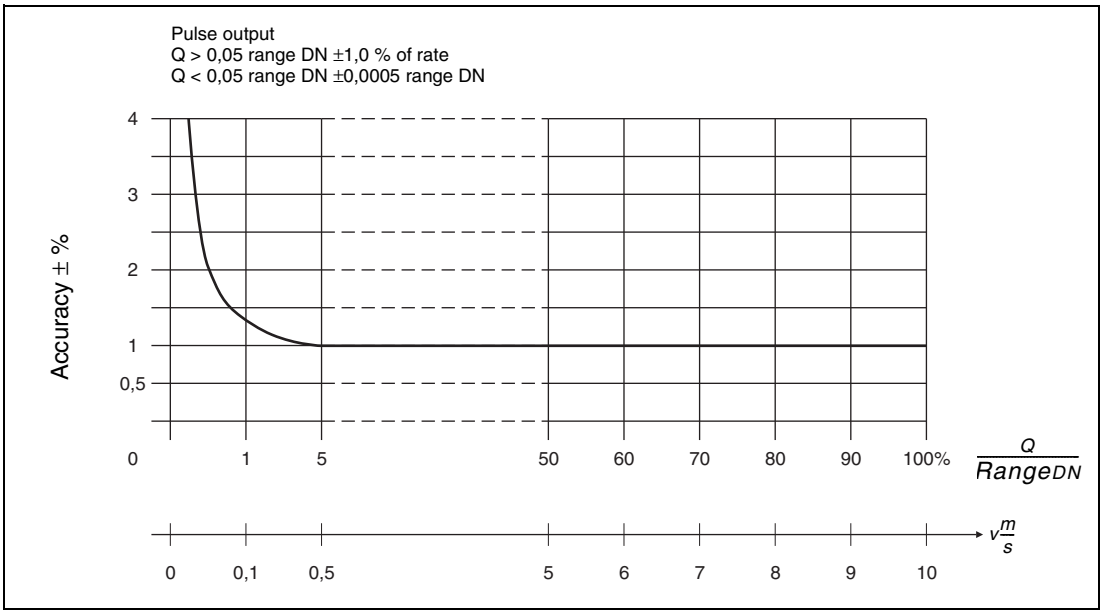


Abb. 25:

12.3 Converter data

12.3.1 General data

≥ 20 µS/cm (Standard)
≥ 5 µS/cm with preamplifier
≥ 0,5 µS/cm with preamplifier

Minimum response time	10 ms

Power supply

AC voltage	24 / (48) / (110) / 115 / (120) / 230 / (240) V ac
Allowable voltage variation	±10 %
Line frequency	50/60 Hz ±6 %
Power consumption	≤ 30 VA (primary and converter)
Ambient temperature	-10 °C to +50 °C
Protection class per DIN 40050	IP 65 for field mount housing IP 00 for 19" insert module

Important

Since the screw-type conduit fitting are protected with only a dust cap or socket the protection class of the instrument cannot be guaranteed until the cables or the enclosed rubber gasket have been installed.

This also applies to the tightening of Pg compression nut as well as the careful closing of the housing lid.

Electrical connections

Field mount housing
Screw-type conduit fittings M 20 x 1.5

19'' Design
Screw terminal, plug in

Signal Cable
A 10 m signal cable is supplied with each meter. The maximum signal length is a function of instrument design:

- max. 50 m for standard design (≥ 20 µS/cm) and for certified Volume Flow Integrators.
- max. 200 m for designs with preamplifiers (≥ 5 µS/cm).

Display
2 x 16 character dot matrix display with background lighting. For further information see Section 7.

12.3.2 Designs and weight

Field mount housing
Cast light metal painted, paint coat 60 µm thick, lower part (RAL 7012), upper part (RAL 9002) for dimensions see Page 13, weight approx. 4.2 kg.

19'' Insert module, 28 TE
(21 TE converter an 7 TE control card), 3 HE, 167 mm long, therefore 3 inserts per modular mounting assembly, for dimensions see Page 13, weight approx 1.8 kg. Design with relay outputs. Optocoupler outputs only available as replacement instrument!

19'' Insert module, 21 TE
(Converter module only without control card) 3 HE, 167 mm long, therefore 4 inserts per modular mounting assembly, for dimensions see Page 13, weight approx. 1.6 kg. Only optocoupler outputs available.

12.3.3 Output signals

Standard
The contact ouputs can be configured as relays or optocouplers.

Contact output

Pre-batch contact	terminals P1, P2
End contact	terminals P3, P4
Alarm contact	terminals V5, V6
System alarm contact	terminals V7, V8, V9

Relay contact
Max. 28 V, max. 0.5 A, max. 8 W or

Optocoupler
$U_{CE} \leq 25$ V, $I_{CE} \leq 7.5$ mA

Options

Unscaled pulse output (0–10 kHz)
Pulse factor
0 % flow rate = 0 kHz, linear to 100 % flow rate = 10 kHz
not scalable!

Pulse width
0.032 ms

Passive, Optocoupler (terminals 59, 60)
Optocoupler 5 V < U_{CE} < 25 V, 5 mA < I_{CE} < 30 mA

Detector empty pipe (terminals V5, V6)
Automatic shut off when pipe empties from detector empty pipe with a signal over the alarm contact (max. cable length 50 m).

Important

This option is not available for primaries with preamplifiers installed and for standard primary <DN 10.

Serial data link

RS 485 (terminals T-, T+, R-, R+)
Vpp = 5 V. Input impedance ≥12 kOhm
Max. Cable length ≤ 1200 m
Max. no. of instruments: 32 connected in parallel

The following baudrates can be selected:
110, 300, 600, 1200, 2400, 4800, 9600, 14400, 28800 Baudrates.
We recommend shielded cable with individually twisted pairs.

Unscaled pulse output plus data link
In addition to the RS 485 data link options the following configuration can be selected. The alarm output is no longer available.

Unscaled pulse output (0–10 kHz)
Pulse width
0.032 ms

Passive optocoupler (terminals 59, 60)
Optocoupler U_{CE} < 25 V, I_{CE} < 7.5 mA

12.3.4 Input signals

Start fill (terminals G2, 68)
Optocoupler input 5 V < U_E < 32 V, 1 mA < I_{CE} < 10 mA

Stop fill (terminals G2, 69)
Optocoupler input 5 V < U_E < 32 V, 1 mA < I_{CE} < 10 mA

Batch quantity selection (terminals G2, A1, A2)
Batch 1, 2, 3, 4 and external
Optocoupler input 5 V < U_E < 32 V, 1 mA < I_{CE} < 10 mA

Automatic zero adjust external
The external zero adjust procedure can be initiated over the Start and Stop inputs.

The requirements for the adjustment are a completely full meter pipe at zero flowrate. In order to start the procedure the Stop and Start inputs must be active for at least 2 seconds whereby it should be noted that the Stop input should be actuated at least 100 ms before the Stop input. The adjustment procedure takes ten seconds and cannot be interrupted.

During this ten second period both inputs should be reset.

13 Volume flow integrator for certified applications

The PTB in Brunswick, Germany has certified the design “Electromagnetic volume flow integrator with electrical totalizer” for interstate use. For the volume flow integrator Fill-MAG, comprising of primary and a converter, the following certificates have been granted:

5.721 / 86.02 Electromagnetic volume flow integrator with electrical totalizer for filling kegs with **beer**.

5.721 / 87.05 Electromagnetic volume flow integrator with electrical totalizer other than water **(milk, beverage concentrates and syrups, beer, wort, brine, chemical products)**.

For Magnetic Volume Flow Integrators under certificate 5.721/87.05 Liquids other than Water the Calibration Regulation (EO) of 15.01.1975 is in force, although with the sixth revision 08.03.1985 (BGBl IS.568), in fact the “General Provisions” (EO AV) and the Annex 5 (EO5) “Metering Instruments for Determination of the Volume or Mass of a Flowing Fluid other than Water”, paragraph 2, part 1.

Certified sizes for liquids other than water

Meter size and maximum allowable flow rate						
DN	Q_{max} Liter/min					
25	selectable	60	to	200	in steps of	10
32	selectable	100	to	400	in steps of	10
40	selectable	150	to	750	in steps of	50
50	selectable	250	to	1000	in steps of	50
65	selectable	400	to	2000	in steps of	100
80	selectable	700	to	3000	in steps of	100
100	selectable	900	to	4500	in steps of	100
150	selectable	2000	to	10000	in steps of	500

Minimum flow rate and metered liquid			
DN	min. flow rate l/min	Metered liquid	
25	2	Beer, milk, beverage concentrate, chemical	Fluids > 20µS/cm
32	5	Beer, milk, beverage concentrate, chemical	Fluids > 20µS/cm
40	20	Beer, milk, chemical	Fluids > 20µS/cm
50	200	Beer, beer wort, chemical	Fluids > 20µS/cm
65	500	Beer, beer wort, milk, chemical	Fluids > 20µS/cm
80	500	Beer, beer wort, milk, chemical	Fluids > 20µS/cm
100	2000	Beer wort, brine, chemical	Fluids > 20µS/cm
150	2000	Brine, chemical	Fluids > 20µS/cm

Min. flow range 2.5 m/s
Max. flow range 10 m/s

Important

The flowrate ranges are specified in the tables above. A subsequent range change requires a new calibration on a certified calibration stand.

Please indicate your desired flowrate range with your order in accordance with the tables on Page 79. Note the value of Qmax for the particular sizes and the allowable steps.

Example: DN 25, minimum settable range Qmax = 60 l/min; range changes between 60 l/min and 200 l/min permissible in 10 l/min steps.

Calibration

Calibration of the Electromagnetic Volume Flow Integrator is conducted on the certified calibration stands of ABB in Göttingen. Subsequently, parameters which affect the certification can only be changed in the presence of a certification inspector.

Accessories

Accessories such as volume flowrate indicators, recorders or control system as well as certified printers, volume setting devices or remote totalizers may be connected.

Printers, volume setting devices and remote totalizers - if required - must be connected to the Electromagnetic Flowmeter with Volume Flow Integrator during the calibration.

Installation Requirements

Straight sections with the same diameter as the inlet diameter of the primary are to be installed up and downstream of the flowmeter. The length of the straight section upstream of the primary must be at least 10 x the size of the primary and the length of the downstream section at least 5 x.

The primary must be completely filled with liquid at all times.

The distance (signal cable length) between primary and converter may not exceed 50 m.

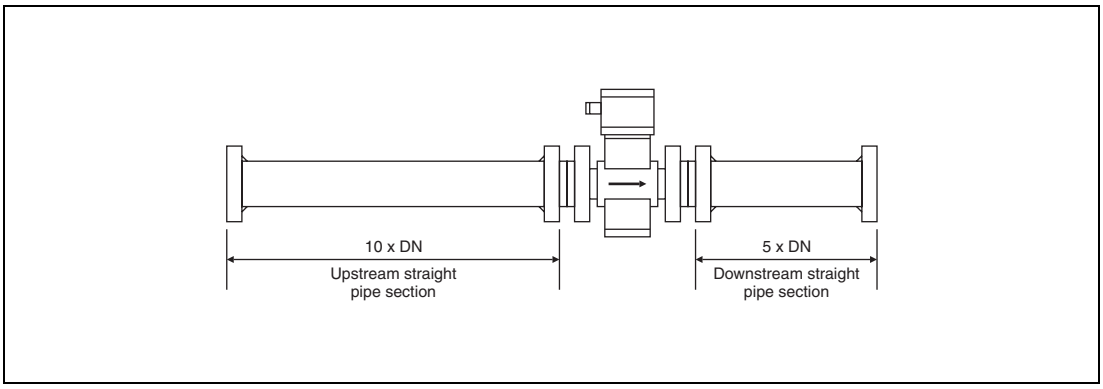


Abb. 26:

KEG filling

For keg sizes with their corresponding volumes can be set and selected by means of external contacts (e. g from an optically determined keg size). The corresponding Pre-batch contacts can also be set individually. The automatic Overrun Correction responds to the continually changing process conditions.

The Fill-MAG checks the under fillings and determines if the value lies within the tolerance limits and if not signals an error condition. The same is true for over fillings. The connections and control functions of the Fill-MAG system have been developed in conjunction with the suppliers of filling systems.

Output contacts

Pre-batch contact
e. g. 27 liter (for 30 l KEG)
e. g. 47 liter (for 50 l KEG)

End contact
e. g. 30 liter
e. g. 50 liter

Control inputs

Important

The control inputs at the converter are optocoupler inputs to provide galvanic isolation. For the various input functions a 24 V dc supply is required, to be provided by the user.

Start fill (terminals G2, 68)
The fill cyle is initiated by the ext. start pulse (e. g. through an SPC).

Stop fill (terminals G2, 69)
The fill cycle is interrupted by the ext. stop pulse.

External batch size selection (terminals G2, A1, A2)
a) from a manual switch
b) from ext. keg size detector[1)]

[1)] A manual override switch must be provided for the ext. keg size detector system to permit filling of a certified (30 l) keg which has the dimensions of a 50 l keg.

14 Overview, input parameters and settings

Meter location:

Primary type: Converter type:

Order no.: Serial no.: Order no.: Serial no.:

Parameter		Range of values
Program protection code		between 0–255
Language:		German, English
Batch selection		Batch 1, 2, 3, 4 or external
Batch quantity 1		
Pre-batch quantity 1		
Batch quantity 2		
Pre-batch quantity 2		
Batch quantity 3		
Pre-batch quantity 3		
Batch quantity 4		
Pre-batch quantity 4		
Overrun time		between 100–2000 ms
Mean value correction factor		between 0–100
Splash loss amount		between ±1000 (ml, l, ...)
Calibration		±10 %
System alarm		100 ms - pulse/continuous
Max. batch time 1		between 0–9999 s
Max. batch time 2		between 0–9999 s
Max. batch time 3		between 0–9999 s
Max. batch time 4		between 0–9999 s
Overfilling		between 0–40 %
Underfilling		between 0–40 %
Meter size:		DN 1 to DN 400 mm
Range units		ml, l, hl, m³, /s, /min, /h, igp, bbl, /s, /min, /h, bls, /min, /h, /day, gp, /min, /h, mg, /day, g, kg, t, /s, /min, /h
Range DN 10 m/s:		dependent upon size
Range >forward/<reverse		0,05 $Q_{max\ DN}$–1,0 $Q_{max\ DN}$
Totalizer units:		ml, l, hl, m³, igal, gal, mgal, bbl, bls, g, kg, t
Pulse factor:		calculated by the converter
Low flow cut-off:		0–10 %
Damping:		0.2–60 seconds
Density:		0.01 g/cm³–5 g/cm³
System zero:		+/- 0 to 1500 Hz
Communication:		ASCII, µDCI-Binary, printer protocol 1–4
Instrument address:		0 to 99
Baudrate:		110–9600, 14400, 28800
Printer type:		F&P DOCUPRINT / Standard (40 Z/Z)
Detector empty pipe:		ON/OFF
Threshold:		0 to 100
Outputs:	❑ Optocoupler	❑ Relay
Detector empty pipe:	❑ yes	❑ no
Preamplifier:	❑ 5 µS/cm	❑ 0.5 µS/cm
Unscaled pulse output (Opto):	❑ yes	❑ no
Communication RS485:	❑ yes	❑ no
Certified:	❑ yes	❑ no

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