

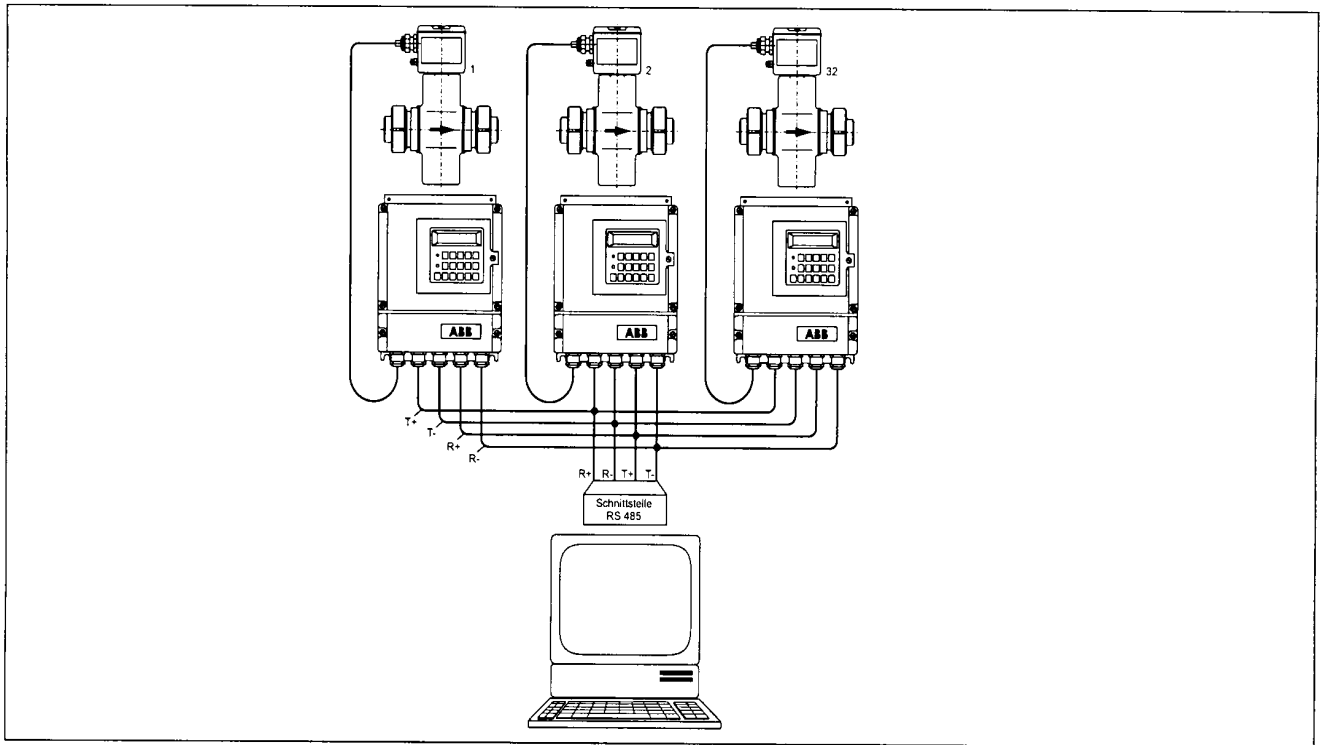
FILL-MAG

Electromagnetic Flowmeter with AC Excitation Series 50ES7000

From Software D699B074U01 A.70

ASCII-Communication

D184B001U55 Rev. 1 / 11.94



ABB

ASCII-Communication FILL-MAG

General/Protocol/Monitor Mode

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1. General Data Link Description

The converter 50ES7000 can be operated over a serial data link, it can be configured and its data accessed while online. A coupling to a process control system, a PC or a freely programmable control device can be achieved.

The communication rate can be selected in a range from 110 to 28800 baud. The following baud rates are available for selection:

110, 300, 600, 1200, 2400, 4800, 9600, 1440 and 28800

The following communication protocol was chosen:

- START, D0, D1, D2, D3, D4, D5, D6, PARITY, STOP -

START 1 Startbit
 D0-D6 7 Databits
 PARITY 1 Paritybit (even)
 STOP 1 Stopbit

The data link hardware is available in either a RS 232C or RS 485 configuration. The RS 232C is not bus compatible, i.e., it is not possible to communicate with more than one instruments on a single line.

There are two software data link protocols available to the user:

μDCI Binary and ASCII

The first protocol is designed especially for F&P μDCI Instrument family (see μDCI Data Link Protocol 50ES7000)

The second protocol (ASCII) is described herein.

2. ASCII Communication Protocol

A communication is always established from a host computer. The converter only responds to an appropriate command from the host computer.

Converter data can be interrogated (Monitor Mode) or reconfigured (Configuration Mode).

The communication is always initiated with the command SOH (Start of Header = 01H) followed by "M" for monitor mode or "P" for configuration mode as well as a "two character instrument address". Then "two function codes" for the required function followed by a "maximum of eight data bytes" are transmitted. The transmission is terminated with the "CR" (carriage return) and "LF" (line feed) codes.

The converter also initiates its response with "SOH", followed by the "two function codes", a "maximum of eight data bytes". The transmission is terminated with the "CR" and "LF" codes.

The data can include a sign ("- " for minus) and (". " for decimal point). Leading or enhancing zeros need not be transmitted.

All data received from the converter is subjected to a number of checks. In addition to the even parity monitoring the converter checks for exact conformity to the communication protocol (codes as well as the number of and type of data). Additionally the reception of new data is checked for plausibility. In the event of an error the converter transmits a error message (function code "X" and a "two digit error number"). If an error is not detected the 50ES7000 accepts the new data and transmits as an acknowledgement to the host computer the same data as received.

The is transmission terminated.

3. Monitor Mode

In this operating mode all the converter parameter settings and status information can be interrogated. The protocol has the following format:

a) Interrogation from host computer

Host computer → converter	
SOH M A1 A0 K1 K0 CR LF	
.	Line feed = 0AH
.	Carriage return = 0DH
.	Two ASCII code characters
.	Two digit ASCII code address
. M	for monitor mode operation
Start of header = 01H	

b) Response from converter

Converter → host computer	
SOH K1 K0 D7-D0 CR LF	
.	Line feed = 0AH
.	Carriage return = 0DH
.	Max of eight ASCII code databits
.	Two digit ASCII code address
Start of header = 01H	

Maximum of eight data bytes including a decimal point (".") and minus ("-") can be transmitted by the converter.

The entry of the data link address must always include two digits.

ASCII-Communication FILL-MAG Monitor Mode

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3.1 Function Codes in the Monitor Mode

All parameters and status information can be interrogated by the computer through the use of function codes. Only capital letters are accepted as correct entries.

3.1.1 A1 Fill Volume 1

A1 is used to access the Fill Volume 1 setting. The response always contains seven places. The units of the fill volumes can be accessed in the Units, Qmax register E1 (3.1.17).

3.1.2 A2 Fill Volume 2

See Fill Volume 1 (3.1.1).

3.1.3 A3 Fill Volume 3

See Fill Volume 1 (3.1.1).

3.1.4 A4 Fill Volume

See Fill Volume 1 (3.1.1).

3.1.5 BN Selected Fill Volume

The output is 3 bytes long. It designates the selected Fill Volume 1 to 4.

<u>Data</u>	<u>Meaning</u>
001	Fill Volume 1
002	" 2
003	" 3
004	" 4

3.1.6 BS Fill Volume Selection Method

BS provides information regarding the method of fill volume selection. The response contains one byte with the following meaning:

<u>Data</u>	<u>Meaning</u>
0	External inputs A1 and A2 at the connection terminals are active for fill volume selection.
1	Fill volume selection from the data link or keypad.

3.1.7 B1 Fill Volume 1 Counter

This counter is incremented by one for every filling of Fill Volume 1. It is reset by the function LZ (Reset Totalizers and Counters 4.1.19) or by L1 (Reset Fill Volume 1 Counter 4.1.20).

The response contains seven digits.

3.1.8 B2 Fill Volume 2 Counter

See Fill Volume 1 Counter (3.1.7)

3.1.9 B3 Fill Volume 3 Counter

See Fill Volume 1 Counter (3.1.7)

3.1.10 B4 Fill Volume 4 Counter

See Fill Volume 1 Counter (3.1.7)

3.1.11 DP Damping

Reports of the damping setting for the output current in seconds. Six data bytes.

3.1.12 DI Density

Reports the density in g/cm³. Six data bytes.

3.1.13 DR Empty Pipe Detector

Reports if the Empty Pipe Detector (when installed) is enabled or disabled. The response contains one digit.

<u>Data</u>	<u>Meaning</u>
0	Empty Pipe Detector disabled
1	Empty Pipe Detector enabled

3.1.14 DS Threshold, Empty Pipe Detector

Reports the present threshold setting for the Empty Pipe Detector. The response contains three digits.

3.1.15 E0 Error Register 0

This register provides information from the converter regarding the encountered errors which have been signalled on the converter alarm contacts. The eight register bits are transmitted as eight ASCII characters in the following format.

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
.	
.	.	.	.	.	.	.	.	ERROR 0
.	
.	.	.	.	.	.	.	.	ERROR 2
.	.	.	.	.	.	.	.	Reference too small
.	
.	
.	.	.	.	.	.	.	.	ERROR 7
.	.	.	.	.	.	.	.	Uref too large (negative)
.	.	.	.	.	.	.	.	Uref too large (positive)

ERROR 9
Excitation defective

3.1.16 E1 Error Register 1

This register provides information from the converter regarding the encountered errors which have been signalled on the converter alarm contacts. This register is reset only when the next start pulse is sent.

The eight register bits are transmitted as eight ASCII characters in the following format.

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
.	
.	.	.	.	.	.	.	.	Maximum fill
.	.	.	.	.	.	.	.	time exceeded
.	.	.	.	.	.	.	.	Flow rate greater
.	.	.	.	.	.	.	.	than low flow cutoff
.	.	.	.	.	.	.	.	+ 5% (at no flow)
.	.	.	.	.	.	.	.	The automatic zero is
.	.	.	.	.	.	.	.	greater than 5%
.	.	.	.	.	.	.	.	Last fill was an overfill
.	.	.	.	.	.	.	.	Last fill was an underfill
.	.	.	.	.	.	.	.	Internal use
.	.	.	.	.	.	.	.	Internal use
.	.	.	.	.	.	.	.	Internal use

3.1.17 EI Units, Qmax

The units for RangeDN (QN - 3.1.38) and Qmax (Q> - 3.1.37)

<u>Data</u>	<u>Meaning</u>	
000	l/s	liters
001	l/min	
002	l/h	
016	hl/s	hectoliters
017	hl/min	
018	hl/h	
032	m ³ /s	cubic meters
033	m ³ /min	
034	m ³ /h	
048	igps	Imperial gallons
049	igpm	
050	igph	
064	mgd	US gallons
065	gpm	
066	gph	[EDM Note: u ?]
080	bbl/s	barrels (31 gallons)
081	bbl/min	
082	bbl/h	
096	bls/day	barrels (42 gallons)
097	bls/min	
098	bls/h	[EDM Note: /s ?]
112	kg/s	kilograms
113	kg/m	
114	kg/h	
128	t/s	tons (metric)
129	t/min	
130	t/h	
144	g/s	grams
145	g/min	
146	g/h	
160	ml/s	milliliters
161	ml/min	
162	ml/h	

The response contains eight digits.

3.1.18 EZ Units, Totalizer

The units for the Total Volume Totalizers 1,2,3 and 4 (Z1 to Z4 - 3.1.52 to 3.1.55), for the Selected Totalizer Value (ZA - 3.1.56), for the Secondary Flow Volume (NM - 3.1.27), for the Secondary Flow Correction (NK - 3.1.28), for the Flash Off Volume (QK - 3.1.39), for the Fill Volumes 1,2,3, and 4 (A1 to A4 - 3.1.1 to 3.1.4) and for the Anticipatory Volume 1,2,3 and 4 (V1 to V4 - 3.1.48 to 3.1.51)

<u>Data</u>	<u>Meaning</u>
000	l liters
001	hl hectoliters
002	m ³ cubic meters
003	igal Imperial gallons
004	gal US gallons [EDM Note: u?]
005	mgal US million gallons
006	bbl barrels (31 gallons)
007	bls barrels (42 gallons)
008	kg kilogram
009	t tons (metric)
010	g grams
011	ml milliliters

The response contains 3 digits.

3.1.19 I> Pulse Factor

Report from the converter of the calculated pulse factor (pulses/unit). The units are stored in Units, Totalizer (EZ - 3.1.18). The response contains six data bytes.

3.1.20 IB Pulse Width

Report of the pulse width of the scaled pulse output. The pulse width is based on 0.064 ms. The response contains six digits.

3.1.21 IO Current Output

Reports the presently configured current output range setting as described by a three digit code.

<u>Data</u>	<u>Meaning</u>
000	0-20 mA
001	4-20 mA
002	0-10 mA
003	2-10 mA

3.1.22 IA Alarm Current

Reports the current output value in the event of an alarm condition. The response contains one digit.

<u>Data</u>	<u>Meaning</u>
0	0%
1	130 %

3.1.23 KK Calibration

KK indicates the meter primary calibration in percent. The response contains six digits.

3.1.24 MO Instantaneous Flowrate in Percent

Reports the instantaneous flow rate value in percent. The second character "O" is replaced by the flow direction code (">" for forward flow, "<" for reverse flow). The response contains six digits.

3.1.25 MF Averaging Factor

The averaging factor indicates the number of measurements to be included in the secondary flow measurement in order to determine the secondary flow correction. When MF=0 the automatic correction is disabled. The response contains three digits.

3.1.26 NG System Zero

Report of the configured system zero in Hz. The response contains six digits.

3.1.27 NM Secondary Flow Volume

Reports the measured secondary flow volume of the last fill. The units can be determined from the Units, Totalizer register EZ (3.1.18). The response contains six digits.

3.1.28 NK Secondary Flow Correction Volume

The converter reports the value by which the secondary flow volume is to be corrected (see Configuration Manual). The response contains six digits. The units can be determined from the Units, Totalizer register EZ (3.1.18).

3.1.29 NZ Secondary Flow Time Interval

The secondary flow time interval during which the secondary flow volume is measured. The units are seconds and the response contains six digits.

3.1.40 ST Status Register

The bits in the status register are reported in the following manner (each bit is reported as a "0" or "1" ASCII character):

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
.
.	Error
.	Error (Error 0
.	to Error 9; see
.	3.1.15) was
.	detected
.	Mains interrupt
.	A mains interrupt
.	was detected
.	Self check
.	The converter is in a
.	self test mode
.	New parameter
.	Parameters were changed from
.	the keypad
.	Low flow cutoff
.	The low flow cutoff for the flow
.	rate display and the current output
.	is enabled
.	Fill cycle in progress
.	The fill cycle (including secondary flow
.	measurement) is in progress
.	Anticipatory contact
.	The anticipatory contact is closed
.	End contact
.	The end contact is closed

3.1.41 SM Low Flow Cutoff

Report of the low flow cutoff value in percent (applies to the display and the current output). Response in six data bytes.

3.1.42 SP Language

Report of the selected language setting in a three digit code format:

<u>Code</u>	<u>Meaning</u>
000	German
001	English

3.1.43 UF Underfill

Report of the allowable underfill volume setting in percent of the selected fill volume. If the fill volume is below this value the alarm contact is actuated, the corresponding bit in Error Register 1 (E1 - 3.1.16) is set and the corresponding counter (01 to 04 - 3.1.32 to 3.1.35) is incremented. This option is disabled when the value is 0%. Six digit response.

3.1.44 U1 Number of Underfills 1

Report of the number of measured underfills for fill volume 1. The counter can be reset with the function "Totalizer Reset" (LZ - 4.1.19) or with "Counter Fill Volume 1 Reset" (L1 - 4.1.20). The response contains seven digits.

3.1.45 02 Number of Underfills 2

See 01 - Number of Underfills 1 (3.1.44)

3.1.46 03 Number of Underfills 3

See 01 - Number of Underfills 1 (3.1.44)

3.1.47 04 Number of Underfills 4

See 01 - Number of Underfills 1 (3.1.44)

3.1.48 V1 Anticipatory Volume 1

The converter reports the anticipatory volume value setting which is used for Fill Volume 1. The data response contains seven digits. The units can be accessed in the Units, Totalizer register E1 (3.1.18).

3.1.49 V2 Anticipatory Volume 2

See Anticipatory Volume 1 (3.1.48)

3.1.50 V3 Anticipatory Volume 3

See Anticipatory Volume 1 (3.1.48)

3.1.51 V4 Anticipatory Volume 4

See Anticipatory Volume 1 (3.1.48)

3.1.30 NW Meter Size

The meter size is reported as a three digit code:

Code	Meaning	
	mm	inch
000	3	1/10
001	4	5/32
002	5	3/16
003	6	1/4
004	8	5/16
005	10	3/8
006	15	1/2
007	20	3/4
008	25	1
009	32	1-1/4
010	40	1-1/2
011	50	2
012	65	2-1/2
013	80	3
014	100	4
015	125	5
016	150	6
017	200	8
018	250	10
019	300	12
020	350	14
021	400	16
039	1	1/25
040	2	1/12

3.1.31 OF Overflow

Report of the allowable configured overfills in percent of the selected fill volume. If the filling exceeds the allowable limits the system alarm contact is actuated, the corresponding bit in Error Register 1 (E1 - 3.1.16) is set and the corresponding counter (01 to 04 - 3.1.32 to 3.1.35) is incremented. This option is disabled when the value is 0%. Six digit output.

3.1.32 01 Number of Overfills 1

Report of the number of measured overfills for Fill Volume 1. The counter can be reset with the function "Totalizer Reset" (LZ - 4.1.19) or with "Counter Fill Volume 1 Reset" (L1 - 4.1.20). The response contains seven digits.

3.1.33 02 Number of Overfills 2

See 01 - Number of Overfills 1 (3.1.33)

3.1.34 03 Number of Overfills 3

See 01 - Number of Overfills 1 (3.1.33)

3.1.35 04 Number of Overfills 4

See 01 - Number of Overfills 1 (3.1.33)

3.1.36 PR Program Version

Reports the Version number of the implemented software. Eight character alphanumeric output.

B074 A70

B074 - F&P Part Number D699B074U01
A70 - Revision A.70

3.1.37 Q> Qmax

Reports the value of Qmax setting. The units for Qmax can be accessed in the Units, Qmax register E1 (3.1.17).

3.1.38 QN RangedN of the Meter Size

Reports the value of RangedN for the selected meter size at a flow velocity of 10 m/s or 33.33 ft/s. The units can be accessed in the Units, Qmax register E1 (3.1.17).

3.1.39 QK Flash Off Volume

If definable losses exist in a fill system, these can be incorporated in a flash off volume correction. The response contains six digits. The units can be accessed in the Units, Totalizer register E1 (3.1.18).

ASCII-Communication FILL-MAG Configuration Mode

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4.1 Function Codes in Configuration Mode

4.1.1 AG Automatic System Zero Adjust

With this command the automatic zero adjustment cycle is initiated. The command is acknowledged immediately, the cycle duration is ca. 30 seconds.

4.1.2 AD Address

The instrument address of the converter can be changed over the communications link. After the change the converter responds to the new instrument address. Maximum of three data bytes.

Data Value Range and Error Messages:

$0 \leq \text{entry} < 100$

Error Number	Cause
22	Entry > 99

4.1.3 A1 Fill Volume 1

Fill Volume 1 can be configured with the command A1. A maximum of seven bytes including the decimal point are available. The units for the fill volume correspond to those set in the Units, Totalizer register EZ (3.1.18).

Error Number	Cause
90	Fill volume too large
91	Fill volume ≤ 0

4.1.4 A2 Fill Volume 2

See Fill Volume 1 (4.1.9)

4.1.5 A3 Fill Volume 3

See Fill Volume 1 (4.1.9)

4.1.6 A4 Fill Volume 4

See Fill Volume 1 (4.1.9)

4.1.7 BA Baud Rate

The signal converter serial communications transmission speed can be reconfigured by changing the BA function parameter. After the change the converter operates with the new baud rate. No response message is issued for this configuration change.

In the event of an unsuccessful parameter change the converter issues the following error message at the old baud rate. The baud rate is configured using a maximum three digit code:

Code	Baud
000	110
001	300
002	600
003	1200
004	2400
005	4800
006	9600
007	14400
008	28800

Possible error messages:

Error Number	Cause
24	Entry > 8

4.1.8 BN Fill Volume Selection

The desired fill volume is selected by transmitting data 1 to 4. If a 0 is transmitted, the fill volume selection is to be made from the two external contacts A1 and A2. The maximum three digit entry cannot contain a decimal point or a sign.

Data Value Range and Error Messages:

$0 \leq \text{entry} < 5$

Error Number	Cause
28	Entry > 4

4.1.9 DP Damping

Damping configuration. Maximum of six data bytes including the decimal point. Units are seconds.

Data Value Range and Error Messages:

$0,2 \leq \text{entry} < 60$

Error Number	Cause
20	Entry ≥ 60
21	Entry < 0.2

4.1.10 DI Density

Enter the density in gm/cm³. Maximum six data bytes.

Data Value Range and Error Messages:

$0.01 \leq \text{entry} < 5$

Error Number	Cause
44	Entry > 5.0
45	Entry < 0.01

4.1.11 DR Empty Pipe Detector

The empty pipe detector (option) can be enabled or disabled by a function code.

Function Code	Meaning
0	Detector disabled
1 - 155	Detector enabled

4.1.12 DS Threshold Empty Pipe Detector

The threshold value for the empty pipe detector can be entered between 0 and 155. Entry maximum three digits.

Data Value Range and Error Messages:

0 ≤ Entry ≤ 155 [EDM NOTE: 156?]

Error Number	Cause
56	Entry > 155

4.1.13 EI Units, Qmax

A three digit code is used to configure the units. It applies for RangedN (QN) and Qmax (Q>).

Code	Meaning
000	l/s liters
001	l/min
002	l/h
016	hl/s hectoliters
017	hl/min
018	hl/h
032	m ³ /s cubic meters
033	m ³ /min
034	m ³ /h
048	igps Imperial gallons
049	igpm
050	igph
064	mgd US gallons
065	gpm
066	gph [EDM Note: u ?]
080	bbl/s barrels (31 gallons)
081	bbl/min
082	bbl/h
096	bls/day barrels (42 gallons)
097	bls/min
098	bls/h
112	kg/s kilogram
113	kg/m
114	kg/h
128	t/s tons (metric)

129	t/min	
130	t/h	
144	g/s	grams
145	g/min	
146	g/h	
160	ml/s	milliliters
161	ml/min	
162	ml/h	

Possible error messages:

Error Number	Cause
48	Incorrect code number

4.1.14 EZ Units, Totalizer

The units are configured using a maximum three digit code. It applies to all totalizers.

Code Meaning

000	l	liters
001	hl	hectoliters
002	m ³	cubic meters
003	igal	Imperial gallons
004	gal	US gallons
		[EDM Note: u?]
005	mgal	US million gallons
006	bbl	barrels (31 gallons)
007	bls	barrels (42 gallons)
008	kg	kilogram
009	t	tons (metric)
010	g	grams
011	ml	milliliters

Possible error messages:

Error Number	Cause
52	Code number > 11

4.1.15 FI Fill Completed

A running fill cycle can be interrupted with this command.

4.1.16 IO Current Output

The current output can be configured using a three digit code:

Code	Meaning
000	0-20 mA
001	4-20 mA
002	0-10 mA
003	2-10 mA

Possible error messages:

Error Number	Cause
62	Entry > 3

4.1.17 IA Alarm Current

The current output value which is to be set in the event of an alarm is configured with a three digit code:

Data Value Range and Error Messages:

0	0% output
1-255	130% output

4.1.18 KK Calibration

The calibration of the meter primary can be changed in percentage steps with this function. Maximum six digit entry.

Data Value Range and Error Messages:

-10 ≤ entry ≤ 1-

Possible error messages:

Error Number	Cause
58	Entry > 10
58	Entry < -10

4.1.19 LZ Reset All Counters and Totalizers

The internal counters and totalizers are reset with this command:

- a) Fill volume counters 1 to 4
- b) Total fill volume totalizers 1 to 4
- c) Overfill counters 1 to 4
- d) Underfill counters 1 to 4
- e) Selected fill volume totalizer value, when no fill cycle is in progress.

4.1.20 L1 Reset Fill Volume 1 Counter
The internal counters and totalizers for Fill Volume 1 are reset with this command:

- a) Fill volume counters 1
- b) Total fill volume totalizers 1
- c) Overfill counters 1
- d) Underfill counters 1
- e) Selected fill volume totalizer value, when no fill cycle is in progress.

4.1.21 L2 Reset Fill Volume 2 Counter

The internal counters and totalizers for fill volume 2 are reset with this command:

- a) Fill volume counters 1
- b) Total fill volume totalizers 1
- c) Overfill counters 1
- d) Underfill counters 1
- e) Selected fill volume totalizer value, when no fill cycle is in progress.

4.1.22 L3 Reset Fill Volume 3 Counter

The internal counters and totalizers for fill volume 3 are reset with this command:

- a) Fill volume counters 3
- b) Total fill volume totalizers 3
- c) Overfill counters 3
- d) Underfill counters 3
- e) Selected fill volume totalizer value, when no fill cycle is in progress.

4.1.23 L4 Reset Fill Volume 4 Counter

The internal counters and totalizers for fill volume 4 are reset with this command:

- a) Fill volume counters 4
- b) Total fill volume totalizers 4
- c) Overfill counters 4
- d) Underfill counters 4
- e) Selected fill volume totalizer value, when no fill cycle is in progress.

4.1.24 MF Averaging Factor

The number of secondary flow volume measurements to be used for the calculation of secondary flow correction value can be configured with this command. When MF=0 the automatic correction procedure is disabled. Maximum of three digits without a decimal point or sign.

Data Value Range and Error Messages:

0 ≤ entry ≤ 100

Possible error messages:

Error Number	Cause
82	Entry > 100

4.1.25 NW Meter Size

The meter size can be configured with a three digit code.

Code Meaning

	mm	inch
000	3	1/10
001	4	5/32
002	5	3/16
003	6	1/4
004	8	5/16
005	10	3/8
006	15	1/2
007	20	3/4
008	25	1
009	32	1-1/4
010	40	1-1/2
011	50	2
012	65	2-1/2
013	80	3
014	100	4
015	125	5
016	150	6
017	200	8
018	250	10
019	300	12
020	350	14
021	400	16
039	1	1/25
040	2	1/12

Possible error messages:

Error Number	Cause
30	Incorrect code number

4.1.26 NG System Zero

The system zero value can be entered in a range between ± 1500 Hz where the sign designates the flow direction (- for reverse and + for forward).

Data Value Range and Error Messages:

-1500 ≤ entry ≤ 1500

Possible error messages:

Error Number	Cause
54	Entry > 1500
54	Entry < -1500

4.1.27 NK Secondary Flow Correction Volume

The secondary flow correction volume can be changed with the function NK. The entry value must always be less than the fill volume. Maximum six data byte entry. The units correspond to those set in the Units, Totalizer register EZ (3.1.18).

Data Value Range and Error Messages:

-1000 ≤ entry ≤ 1000

Possible error messages:

Error Number	Cause
84	Entry > 1000
84	Entry < -1000

4.1.28 NZ Secondary Flow Time Interval

The time interval during which the secondary flow volume is to be measured is configured in this function (in milliseconds)

Data Value Range and Error Messages:

0 ≤ entry ≤ 2000

100 ≤ entry ≤ 2000 for automatic zero adjust

Possible error messages:

Error Number	Cause
88	Entry > 2000
89	Entry < 0
89	Entry < 100 (with auto. zero adjust)

4.1.29 OF Overfill

Configuration of the allowable overfill volume in percent (based on the presently selected fill volume). If the overfill exceeds the limit, the alarm contact is actuated, the corresponding bit in the Error Register 1 (E1 - 3.1.16) is set and the corresponding counter (01 to 04 - 3.1.32 to 3.1.35) incremented by one. Entry of 0% disables this function. Maximum six digit entry.

Data Value Range and Error Messages:

0 ≤ entry 10

Possible error messages:

Error Number	Cause
66	Entry > 10
67	Entry < 0

4.1.30 Q> Qmax

Configuration of Qmax. The units correspond to the units set in the Units, Qmax register (EI - 3.1.17). Configuration with a maximum of seven data bytes.

Data Value Range and Error Messages:

0.05 RangeDN ≤ entry ≤ RangeDN

Possible error messages:

Error Number	Cause
10	Entry > RangeDN
11	Entry < 0.05 RangeDN

4.1.31 QN Qmax of the Meter Size

In specific instances it may be possible to directly configure RangeDN. The configuration proceeds exactly as described for Qmax (4.1.30).

Data Value Range and Error Messages:

0 ≤ entry ≤ 9999999

Possible error messages:

Error Number	Cause
12	RangeDN cannot be configured
13	Entry ≤ 0

4.1.32 QK Flash Off Volume

If definable losses exist in a fill system, these can be incorporated in a flash off volume correction with QK. Maximum six digit entry. The units correspond to the units set in the Units, Totalizer register (EZ - 3.1.18).

Data Value Range and Error Messages:

-1000 ≤ entry ≤ 1000

Possible error messages:

Error Number	Cause
86	Entry > 1000
86	Entry < -1000

4.1.33 RU Start Fill

A fill cycle can be initiated with this command. No data is to be sent.

4.1.34 SM Low Flow Cutoff

Configuration of the low flow cutoff value in percent. Maximum six digit entry.

Data Value Range and Error Messages:

0 ≤ entry ≤ 10

Possible error messages:

Error Number	Cause
16	Entry < 10
17	Entry < 0

4.1.35 SP Language

Configuration of the language for the display using a maximum three digit code:

Code Meaning

000 German
001 English

Possible error messages:

Error Number	Cause
36	Entry > 1

4.1.36 SA Mains Interrupt Recognition

The mains interrupt recognition (Status Register ST, Bit1, see 3.1.40) can be reset with this command.

4.1.37 UF Underfill

Configuration of the allowable underfill volume in percent (based on the presently selected fill volume). If the fill volume is below this limit, the alarm contact is actuated, the corresponding bit in the Error Register 1 (E1 - 3.1.16) is set and the corresponding counter (01 to 04 - 3.1.44 to 3.1.47) incremented by one. Entry of 0% disables this function. Maximum six digit entry.

Data Value Range and Error Messages:

0 ≤ entry 10

Possible error messages:

Error Number	Cause
68	Entry > 10
69	Entry < 0

4.1.38 V1 Anticipatory Volume 1

The anticipatory volume value which is used for Fill Volume 1 can be configured with this command. The units can be accessed in the Units, Totalizer register EZ (3.1.18). Maximum seven digits entry.

Data Value Range and Error Messages:

0 ≤ entry ≤ fill volume

Possible error messages:

Error Number	Cause
14	Entry > fill volume
15	Entry < 0

4.1.39 V2 Anticipatory Volume 2

See Anticipatory Volume 1 (4.1.38)

4.1.40 V3 Anticipatory Volume 3

See Anticipatory Volume 1 (4.1.38)

4.1.41 V4 Anticipatory Volume 4

See Anticipatory Volume 1 (4.1.38)

4.1.42 T1 Maximum Fill Time

Entry of a maximum fill time value for Fill Volume 1 in seconds. If this time value is exceeded the fill cycle is terminated, the system alarm actuated and the corresponding bit is set in the Error Register 1 E1 (3.1.16). When a 0 is entered this function is disabled. Maximum six digit entry.

Data Value Range and Error Messages:

0 ≤ entry < 10000

Possible error messages:

Error Number	Cause
60	Entry > 9999
61	Entry < 0

4.1.43 T2 Maximum Fill Time 2

See Maximum Fill Time 1 (4.1.42)

4.1.44 T3 Maximum Fill Time 3

See Maximum Fill Time 1 (4.1.42)

4.1.45 T4 Maximum Fill Time 4

See Maximum Fill Time 1 (4.1.42)

5. Error Messages

The data values received are checked in the converter for conformity to the communication protocol as well as for plausibility. In the event of an error the converter sends an error message:

SOH	X	F1	F0	CR	LF
.
.	.	.	.	.	Line feed = 0AH
.	.	.	.	.	Carriage return = 0DH
.	.	.	.	.	2 digit ASCII code error number
.	.	.	.	.	X for error message
.	.	.	.	.	Start of header = 01H

5.1 Protocol and Communication Errors

Error Number	Cause
01	Incorrect mode (only M for monitor mode and P for configuration mode)
02	Incorrect code letter
03	Configuration not possible because parameter has certification protection
04	Number of data bytes exceeded
05	Parity error

5.2 Error Messages in Configuration Mode

Error No.	Code	Meaning
10	Q>	Entry > RangeDN
11	Q>	Entry < 0.05 RangeDN
12	QN	RangeDN not programmable
13	QN	RangeDN ≤ 0
14	V1,V2,V3,V4	Entry > Fill volume
15	V1,V2,V3,V4	Entry < 0
16	SM	Entry > 10
17	SM	Entry < 0
20	DP	Entry ≥ 60
21	DP	Entry < 0.2
22	AD	Entry > 99

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24	BA	Entry > 8
26	BN	Entry > 4
30	NW	Incorrect code number
36	SP	Entry > 1
44	DI	Entry > 5
45	DI	Entry \leq 0.01
48	EI	Incorrect code number
52	EZ	Entry > 11
54	NG	Entry > 1500 or Entry < -1500
56	DS	Entry > 155
58	KK	Entry > 10 or Entry < -10
60	T1,T2,T3,T4	Entry > 9999
61	T1,T2,T3,T4	Entry < 0
62	IO	Entry > 3
66	OF	Entry > 10
67	OF	Entry < 0
68	UF	Entry > 10
69	UF	Entry < 0
82	MF	Entry > 100
84	KK	Entry > 1000 or Entry < -1000
86	QK	Entry > 1000 or Entry < -1000
88	NZ	Entry > 2000
89	NZ	Entry < 0
90	A1,A2,A3,A4	Entry too large
91	A1,A2,A3,A4	Entry \leq 0

6. Remote Display

A terminal may be used on the serial data link to provide a remote display. All information which appears on the converter display is also transmitted to a remote display unit when in the operating mode. The 50ES7000 can also be configured from this unit.

A baud rate of 1200 or 2400 is recommended.

The terminal types available for the remote display are:

- a) F&P Converter Dialog Unit,
- b) ANSI Terminal and
- c) Data Terminal

6.1 F&P Converter Dialog Unit

This terminal provides the simplest and most reliable solution. The operation is over a foil keypad exactly like the one in the converter. Additionally the connection is continuously monitored by the converter and the Dialog Unit. If an interruption occurs the communication is automatically reestablished.

Further detailed information is available in the "F&P Converter Dialog Unit" Instruction Manual.

6.2 ANSI Terminal

If an ANSI Terminal is installed, the communication requires the following command:

```
SOH P A1 A0 ESC X ANSI CR LF
. . . . .
. . . . . Line feed
. . . . . Carriage return
. . . . . ANSI
. . . . . X
. . . . . ESC = 1 BH
. . Two digit ASCII code instrument
. . address
. P for configuration mode
Start of header = 01H
```

The connection is terminated with

ESC O S (PF4)

The 50ES7000 response uses the following ESC Sequences and control characters:

ESC Sequence/ Control Character	Function
ESC [2 J ESC [H ESC [H ESC [2;1 H	Clear screen and cursor home Cursor home Cursor to start of second line
ESC [C ESC [D BEL	Cursor right Cursor left Ring bell

The following terminal keys are available for the communication:

Key	ASCII Character	HEX Code
0	0	30
1	1	31
2	2	32
3	3	33
4	4	34
5	5	35
6	6	36
7	7	37
8	8	38
9	9	39
.	.	2E
RETURN	CR	0D
DEL	DEL	7F
		2D
↑	ESC [A	1B 5B 41
↓	ESC [B	1B 5B 42

6.3 Data Terminal

If a Data Terminal is installed, the communication requires the following command:

```
SOH P A1 A0 ESC X ANSI CR LF
. . . . .
. . . . . Line feed
. . . . . Carriage return
. . . . . TERM
. . . . . X
. . . . . ESC = 1 BH
. . Two digit ASCII code instrument
. . address
. P for configuration mode
Start of header = 01H
```

The connection is terminated with

ESC O S

The 50ES7000 response uses the following control characters:

Control Character	Function
ASCII HEX	
CR LF 0D 0A	Cursor to start of next line
VT CR 0B 0D	Cursor to start of previous line
CR 0D	Cursor to start of line
HT 09	Cursor right
BS 08	Cursor left
BEL 07	Ring bell

The following terminal keys are available for the communication:

Key	ASCII Character	HEX Code
0	0	30
1	1	31
2	2	32
3	3	33
4	4	34
5	5	35
6	6	36
7	7	37
8	8	38
9	9	39
.	.	2E
RETURN	CR	0D
DEL	DEL	7F
↑	VT	2D
↓	LF	0B 0A

Fig.

SENDER
EMPFÄNGER

TRANSMITTER
RECEIVER

7.1.2 Installation RS 232 C

Fig.

Meßumformer Converter

TXD Transmit Data

RXD Receive Data

⊥ Ground

7. Data Link Modules

The 50ES7000 converter is available with various data link hardware options. The following modules are available:

- a) RS232C (V24)
- b) RS485

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

7.1 Interface RS 232 C (V24)

7.1.1 Technical Data RS 232 C

Transmission mode asymmetric

Max. number of transmitters 1

Max. number of receivers 1

Max. cable length 15m

Max. communication rate 20 kBaud

Signal voltage, no load ± 15 V

Signal voltage, under load ± 5 V

7.2 Interface RS 485

Fig.

7.2.1 Technical Data RS 485

Meßumformer	Converter
Sendedaten	Transmitted data
Empfangsdaten	Received data

Transmission mode	symmetric
Max. number of transmitters	32
Max. number of receivers	32
Max. cable length	1200m
Max. communication rate	10 MBaud
Signal voltage, no load	5 V
Signal voltage, under load	1.5 V

Fig.

SYMMETRISCHE	SYMMETRIC
VERBINDUNG	CONNECTION
Symmetrischer	Symmetric
Sender	Transmitter
Differential	Differential
Empf.	Receiver

Cable length as a function of baud rate:

Fig.

Übertragungs-strecke	Transmission distance
" -geschwindigkeit	Transmission speed



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