

# Calculator F4 manual



<b>1</b>	<b>INSTALLATION</b>	<b>4</b>	<b>4</b>	<b>SEALS, METER PROTECTION</b>	<b>15</b>
			<b>4.1</b>	<b>Volume check</b>	<b>15</b>
<b>2</b>	<b>BUTTONS AND JUMPERS</b>	<b>5</b>			
<b>2.1</b>	<b>Push Button</b>	<b>5</b>	<b>5</b>	<b>CONNECTING THE METER / HANDLING</b>	<b>16</b>
<b>2.2</b>	<b>Service Button</b>	<b>5</b>	<b>5.1</b>	<b>Circuit board F4</b>	<b>16</b>
<b>2.3</b>	<b>Test button</b>	<b>5</b>		<b>Connection terminals</b>	<b>17</b>
<b>2.4</b>	<b>Save data button</b>	<b>5</b>	5.2.1	Sensors and M-Bus connection	17
<b>2.5</b>	<b>2/4-Wire jumpers</b>	<b>6</b>	5.2.1.1	EN1434 terminal table	17
<b>2.6</b>	<b>ON/OFF jumper</b>	<b>6</b>	5.2.2	Pulse input connection	18
<b>2.7</b>	<b>Slot jumpers Signal/Power redirecting</b>	<b>6</b>	5.2.3	Pulse output connection	18
			5.2.4	Alarm output connection	18
			5.2.5	Connection 3V/12V	18
			5.2.6	Option board connection	18
			5.2.7	Potential free output	18
			<b>5.3</b>	<b>Battery and mains connection</b>	<b>19</b>
<b>3</b>	<b>DISPLAY</b>	<b>7</b>	<b>5.4</b>	<b>Calculator connection</b>	<b>19</b>
<b>3.1</b>	<b>Back-light</b>	<b>7</b>	<b>5.5</b>	<b>Mains connection and backup battery</b>	<b>19</b>
<b>3.2</b>	<b>Display test</b>	<b>7</b>	<b>5.6</b>	<b>Option board handling</b>	<b>20</b>
<b>3.3</b>	<b>Display modes</b>	<b>8</b>	5.6.1	Option board installation procedure	20
3.3.1	Transport mode	8	5.6.2	Dip switch setting of option board	20
3.3.2	Initial mode ( INIT mode)	8	5.6.3	Installing additional option boards	21
3.3.3	Service mode	9	5.6.4	Configure the option board	21
3.3.4	Test mode	9	5.6.5	Reconfigure option boards	21
3.3.5	10	10	5.6.6	Uninstall, removal of option boards or reconfiguring option boards	21
3.3.5.1	Display Sequence Normal mode	11			
3.3.5.2	Display seq. Normal Mode 2	12	<b>5.7</b>	<b>Cable fittings</b>	<b>22</b>
3.3.5.3	Display sequence normal mode (summary)	12	<b>5.8</b>	<b>Mounting</b>	<b>22</b>
3.3.5.4	Display sequence normal mode schematics	13			
<b>3.4</b>	<b>Error codes</b>	<b>14</b>			

<b>6</b>	<b>METER MEASURING</b>	<b>23</b>	<b>8</b>	<b>TECHNICAL DATA</b>	<b>27</b>
6.1	Calculation of flow	23	8.1	Data output table	27
6.2	Calculation of power	23	8.2	Power supply	28
6.3	Temperature measurement and 4-Wire measurement	23	8.3	Temperature sensors	28
			8.4	Flow sensors	28
			8.5	Temperature ranges	28
<b>7</b>	<b>TESTING, PROGRAMMING &amp; SERVICE</b>	<b>24</b>	8.6	Ambient temperature & Temperature class	28
7.1	Display test	24	8.7	Flow sensor placing	28
7.2	Installation test	24	8.8	Maximum values for power	28
7.3	Service	25	8.9	Dynamic behavior	28
7.3.0	Time	25	8.10	Data output interfaces	28
7.3.1	Date	25	8.11	Pulse outputs	29
7.3.2	Pulse value	25	8.12	Pulse inputs	29
7.3.4	Account days	25	8.13	Alarm output	29
7.3.6	Communication address	25			
7.3.8	Placement of flow sensor placing	25			
7.3.9	Recommended date for battery replacement	25			
7.3.A	Return to normal mode	25			
7.4	Verifying the meter	26			

# 1 Installation

When calculator, meter, is delivered the meter is set to “Normal mode”, but depending on delivery options the meter can be delivered in other “display modes”, see display modes for more information. Follow this procedure to install the meter:

1. Setting of meter, see “Service, setting meter” for more information.
2. Install option boards, see “Install option boards” for more information.
3. Mount the meter, see “Mounting”.
4. Connecting the meter, see “Connections”.
5. Check Seal, see “Seals”.
6. Display and function test, see “Display and function tests”.
7. Set the meter into normal mode, see “Different display modes” for more information.
8. Function test, see “Tests”

## 2 Buttons and jumpers

### 2.1 Push Button

The calculator is equipped with a “Push Button” with the “Push Button” the display can toggle between different values when pushed, enter different sequences when held or enter different display modes when held in combination with one other button, see below for more information.

There are two ways to use the “Push Button”,

1. **Push**, e.g. press (and release) to toggle between different values in the display sequence, see “Display” for more information.
2. **Hold**, e.g. hold push button and hold it pressed until the display changes mode or sequence, see “Display” for more information.



Fig 2.1, Push Button.

Push button

### 2.2 Service Button

This button is used in combination with holding the Push Button to enter service mode.

**Tool:** Screwdriver or any other suitable dull object.

To enter (or exit) *service mode*, hold the service button using a small screwdriver carefully and then hold the “Push Button” until the display sequence changes to “01” (or back to “10”) on the display sequence, see Display for more information on sequence.

Service button

Test button

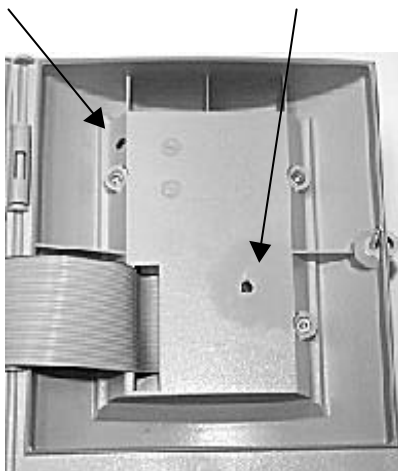


Fig 2.2, Location of service and test buttons

### 2.3 Test button

This button is used in combination with holding the Push button to set meter into test mode.

**Tool:** Test key

To enter (or exit) *test mode*, hold test button using “Test key” and then hold the test button until the display shows a flash (or until flash disappears).



Fig 2.3, Test key

**Note:** only to be used by authorized personnel

### 2.4 Save data button

The save data button is used when saving data is necessary. E.g. when changing batteries or when installing option boards.

This “Save data button” saves makes a read and saves all data from temporary memory to the meters EEPROM. **Note:** The data from any option boards will not be saved.

**Tool :** Test key

To save use the “Test key” and short circuit the “Save data button”, now the meter has stored all temporary data to the EEPROM.

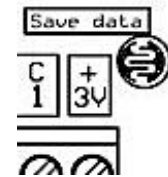


Fig 2.4, Save data button

**Note:** only to be used by authorized personnel

## 2.5 2/4-Wire jumpers

The F3/F4 is standard configured with 2-wire connection, but the meter's programming allows 4-Wire connection.

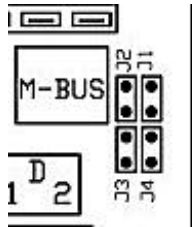


Fig 2.5, 2/4-Wire jumpers

**4-Wire connection**  
remove jumpers J1, J2, J3 and J4.

**2-wire connection**  
put jumpers back at J1, J2, J3 and J4.

**Note:** the placing of the jumpers according to fig 2.5.

## 2.6 ON/OFF jumper

F4 is equipped with an ON/OFF jumper to cut the power from battery, when changing batteries or installing option boards.

**Note:** only when calculator is powered with batteries. To cut power from mains supplied calculator see fig 5.1, 5.1 Circuit board F4.

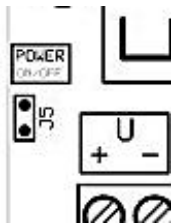


Fig. 2.6, ON/OFF jumper,  
OFF, no jumper

**Power off, no jumper**  
**Power on, jumper on**

**To cut power form mains supplied calculator see fig. 5.1, 5.1 Circuit board F4**

## 2.7 Slot jumpers Signal/Power redirecting

On slot C and D there are jumpers for redirecting power and signals, when these are removed without placing a correct option board in slot, the signals from the meter can be cut and the meters output and measuring can be disabled, depending on which jumper that is wrongly removed

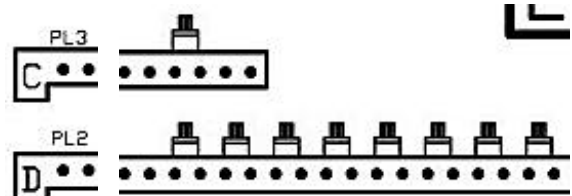


Fig 2.7, Slot jumpers on slot C and slot D

### 3 Display

The F2/F3/F4 Calculators are equipped with an LCD (Liquid crystal display). The display units and decimal setting are specific for each meter configuration, such as show energy in MWh, temperature in Celsius, decimal placing and so on, see also fig.3.1. The display is shown below :

1. Display sequence, in this case “10” default position. The digit “1” displays the sequence and the “0” the value, of the “10”, see also fig. 3.1b.
2. Sensor pulse indicator square,
3. **At error** ( revers to normal ) : The square will appear as long as the meter do not recieve a pulse, and blink when the pulse comes.
4. **High frequency** (2Hz or more): The square will appear steady and disappear on error
5. Value digit, max. seven (7) digits
6. Value unit indicator arrow
7. Different units depending on value displayed, and configuring of meter upon ordering.
8. Decimal placing, **note:** the digits after the decimalplacing “blinks” in accordance with EN1434.

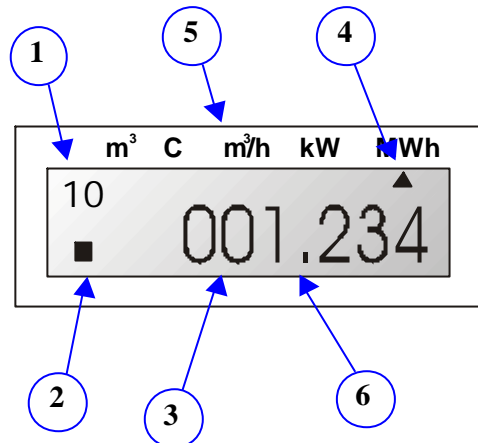


Fig 3.1, Display, m<sup>3</sup>, C ...

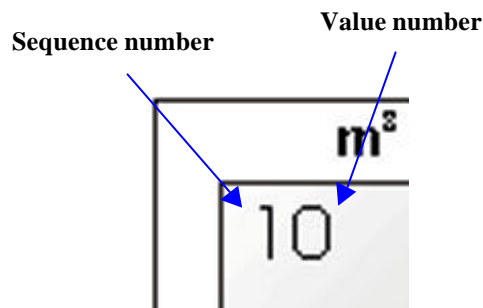


Fig 3.1b, Sequence number, value number.

#### 3.1 Back-light

The display can be equipped with a “back-light” function, which illuminates the display when the “push-button” is pressed or when meter is set to other modes than “Transport mode”. The light will be turned off after one minute if after that the “Push Button” has been pushed.

If the meter is set to Service/INIT/Test –mode the back light will shine steadily. Do not put the meter into these modes during transport when the back-up battery life span can be seriously reduced.

**Note:** The back-light function consumes energy and should not be combined with a meter powered by only batteries.

#### 3.2 Display test

In accordance with EN1434 all the meters F2/F3/F4 have a display test on sequence 12.

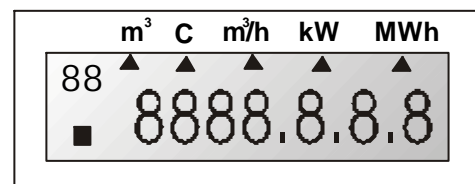


Fig. 3.2, Display test

### 3.3 Display modes

The meter has different display modes, depending on what shall be accessed in the meters. To enter the different modes seals must be broken and different tools shall be used, see below. The meter is normally delivered in “Transport mode”, but depending on programming the meter can also be set to other modes. The modes are :

1. **Transport mode**
2. **Initiation mode ( INIT-Mode)**, see also service mode.
3. **Service mode**, programming by “Push Button”
4. **Test mode**, test and programming by service program.
5. **Normal mode**, operating mode.

**Note:** Avoid to set the meter into “Service/Initial Mode” or “Testing mode” for longer time periods (1 hour), or battery life length can be effected.

#### 3.3.1 Transport mode

This is the mode which the meter normally is delivered in. In transport mode the meter “sleeps” and no measurements or communication can be done.

**To exit “Transport mode”**, hold “Press Button” until the “no” sign disappears, and the sequence digit changes to “00” or “10” depending on setting of meter. Normally when exiting the transport mode meter enters the INIT-mode “00”, see initiation mode for more information.

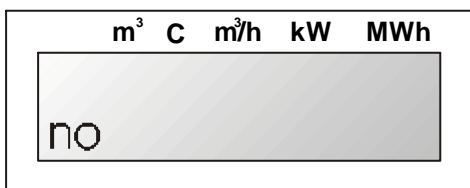


Fig. 3.3, Display Transport mode

#### 3.3.2 Initial mode ( INIT mode)

When meter exits the Transport mode, normally the meter enters the INIT mode. INIT mode is identical with service mode, with the exception of a few sequences missing compared to service mode due to delivering options, see table 3.1 for sequence. In INIT mode meter can be configured see table for more information.

**To change value digit**, push “Push button” until correct value is acquired.

**To change digit to be changed**, hold Push Button until next value digit starts to blink.

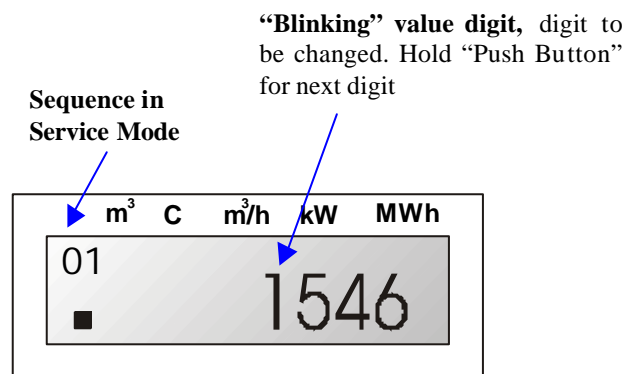


Fig. 3.5, Display Service or INIT mode

### 3.3.3 Service mode

In service mode the setting of the meter can be changed with the “Push Button”, see Buttons for more information on buttons.

**To enter “Service Mode”:** Hold “Service button” and then hold “Push Button” pressed in 1-2 seconds and then release, the display sequence changes mode.

**To exit “Service Mode”:** Same procedure as to enter, see above.

**To change value digit:** Push “Push button” until correct value is acquired.

**To change digit to be changed:** Hold Push Button until next value digit starts to blink. **Note:** The value is stored when the next sequence value is selected.

**To enter next sequence:** Hold Push button until next service sequence appears.

Sequence	Description
00	Time, HHMM
01	Date, YYMMDD
02	Pulse value, 0000-9999 e.g. 2.5l/p is displayed with 2500
03	Pulse value decimal places, 0-4
04	Account days 1, MMDD
05	Account days 2, MMDD
06	Primary communication address set with three (3) digits, e.g. “5” is set to “0005”
07	Resetting stored error time, 1 = Reset stored error time 0 = Do not reset error time
08	Flow sensor placing, 1 = installed at low temp. (default) 2 = installed at high temperature
09	Replacement of battery date, YYMMDD Do not change without consulting ABB Metering AB
0A	Exit service sequence, 1 = Exit 0 = Return to sequence “00”

Table 3.1, Service display sequence,

HH–Hour, mm–Minutes,

YY–Years, MM–months, DD–Days.

See, “Testing ....., Service” for additional information

**Note :** Altering the values in the service sequence can have serious effect on the meter with wrong measuring as a result.

### 3.3.4 Test mode

In test mode the all the meter parameters can be configured, with a “meter service program, v 2.0”. The display will show a flash see fig 3.6.

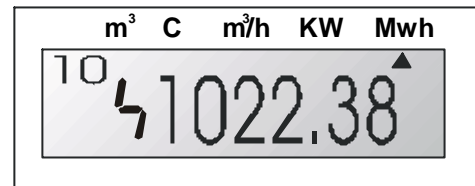


Fig 3.6, Display in Test Mode, “Flash” in display

**Set meter to Test Mode,** use the test key, Hold the test key in “Test button”, see Buttons (short circuit the button), and then Hold the “Push Button” (approximate 1-2 seconds) then release, the display will show a “flash” when entering “Test Mode”.

**Exit test mode,** same procedure as to set meter to Test Mode, see above.

**Service program version 2.00** (00-10-09) or later version can be used to program F4. With the service program the meter can be configured, see Service program manual for more information.

In the service program: **Read type,** the meter programming is read into the service program. **Change mode,** the display mode is changed. **Change type** will erase all previously stored meter readout data in the meter.

**Note:** Avoid to set the meter into “Service/Initial Mode” or “Testing mode” for longer time periods (1 hour), or battery life length can be effected.

**Warning:** Changes in the meter by the service program can seriously affect the meters behavior, such as parameters as battery life length, meter reading can be affected. **Do not** use the service program with out proper education or consulting ABB Metering AB.

**Warning:** When programming the F4 **do not** use Service program lower than version 2.0 or the meter program can be damaged !

### 3.3.5 Normal mode

Normal mode is the meters operating mode. In this mode the meter accumulates values and are ready to communicate measured data through OPTO- , M-Bus, SIOX, display and more.

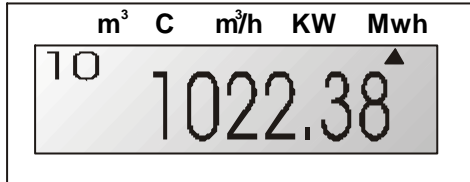


Fig 3.7, Display in Normal mode

**Display sequences**, the first digit in the sequence number announces the display sequence. The second digit announces which value are to be displayed, value number. Each display sequence loops the values within the sequence, with a few exceptions, see flow schematics.

**Read Different values**, press “Push Button” to display the next value. After the last value in the display sequence the display will return to the first value in the sequence in a loop.

**Enter new sequence**, Hold “Push Button” to enter next display sequence, release when correct display sequence is reached. When exiting the last display sequence the display will return to the first display sequence and so on. Notice when exiting display sequence 30 and 40 and the meter will return to display sequence 10.

**Blinking digits**, according to EN1434 the digits after the decimal places blinks.

**Arrow on the correct unit**, the display varies depending on meter configuration ( example, kW or MW ) when a value with a unit is displayed on the arrow will indicate the correct unit. (Only if the display label is correct labeled).

**Return** to default position is normally set to 60s, see table 3.2.

**Note:** when meter is reprogrammed with example the service program the label is not automatically changed.

### 3.3.5.1 Display Sequence Normal mode

Seq	Description
10	Accumulated energy (Default position)
11	Accumulated volume according to flow sensor <sup>1</sup>
12	Display test, see fig.3.2
13	Accumulated volume for pulse input 1, [m <sup>3</sup> ]
14	Accumulated volume for pulse input 2, [m <sup>3</sup> ]
15	Error Code, see Error code
16	Accumulated Error Time, [Minutes]
20	Momentary Power
21	Momentary Flow
22	High Temperature
23	Low Temperature
24	Temperature Difference
30	Account days <sup>2</sup> , when values are stored, [YYMMDD]
31	Acc.d., Accumulated energy
32	Acc.d., Accumulated volume according to flow sensor.
33	Acc.d., Accumulated volume according to energy calculation
34	Acc.d., Energy
35	Acc.d., Accumulated volume pulse input 1, [m <sup>3</sup> ]
36	Acc.d., Accumulated volume pulse input 2, [m <sup>3</sup> ]
37	Possible error code, at time of storage Acc.d.
38	Possible accumulated error time , at the time of storage Acc.d., [Minutes]
40	Monthly registers <sup>3</sup> , date when values are stored, [YYMMDD]
41	M.R., Accumulated energy
42	M.R., Accumulated volume according to flow sensor
43	M.R., Accumulated volume according to energy calculation
44	M.R., Energy
45	M.R., Accumulated volume pulse input 1, [m <sup>3</sup> ]
46	M.R., Accumulated volume pulse input 2, [m <sup>3</sup> ]
47	Possible error code, at time of storage
48	Possible accumulated error time , at the time of storage, [Minutes]
50	Operating time, [Hours]
51	Relevant date, [YYMMDD]
52	Relevant time, [HHMM]
53	Recommended date for battery replacement, [YYMMDD]
60	Communication address, Primary address
A9	Communication address, Secondary address
B0	Meter S/N
63	Pulse value [l/p]
64	Placing of flow sensor, [H/L], L = Low
70	Accumulated volume corresponding to accumulated energy
71	Last remote read accumulated energy
72	Time since latest remote read accumulated energy, [Hours]
73	Error time, [Minutes]
74	Previous Error Code
75	Time for previous Error code, [Minutes]

Table 3.2, Display sequence 10 – 70, normal mode

### 3.3.5.2 Display seq. Normal Mode 2

90	ID Option card A
91	Status option card A
92	ID Option card B
93	Status option card B
94	ID Option card C
95	Status option card C
96	ID Option card D
97	Status option card D
98	ID Option card E
99	Status option card E
9A	ID Option card F
9B	Status option card F
A0	Sequence option card A
B0	Sequence option card B
C0	Sequence option card C
D0	Sequence option card D
E0	Sequence option card E
F0	Sequence option card F

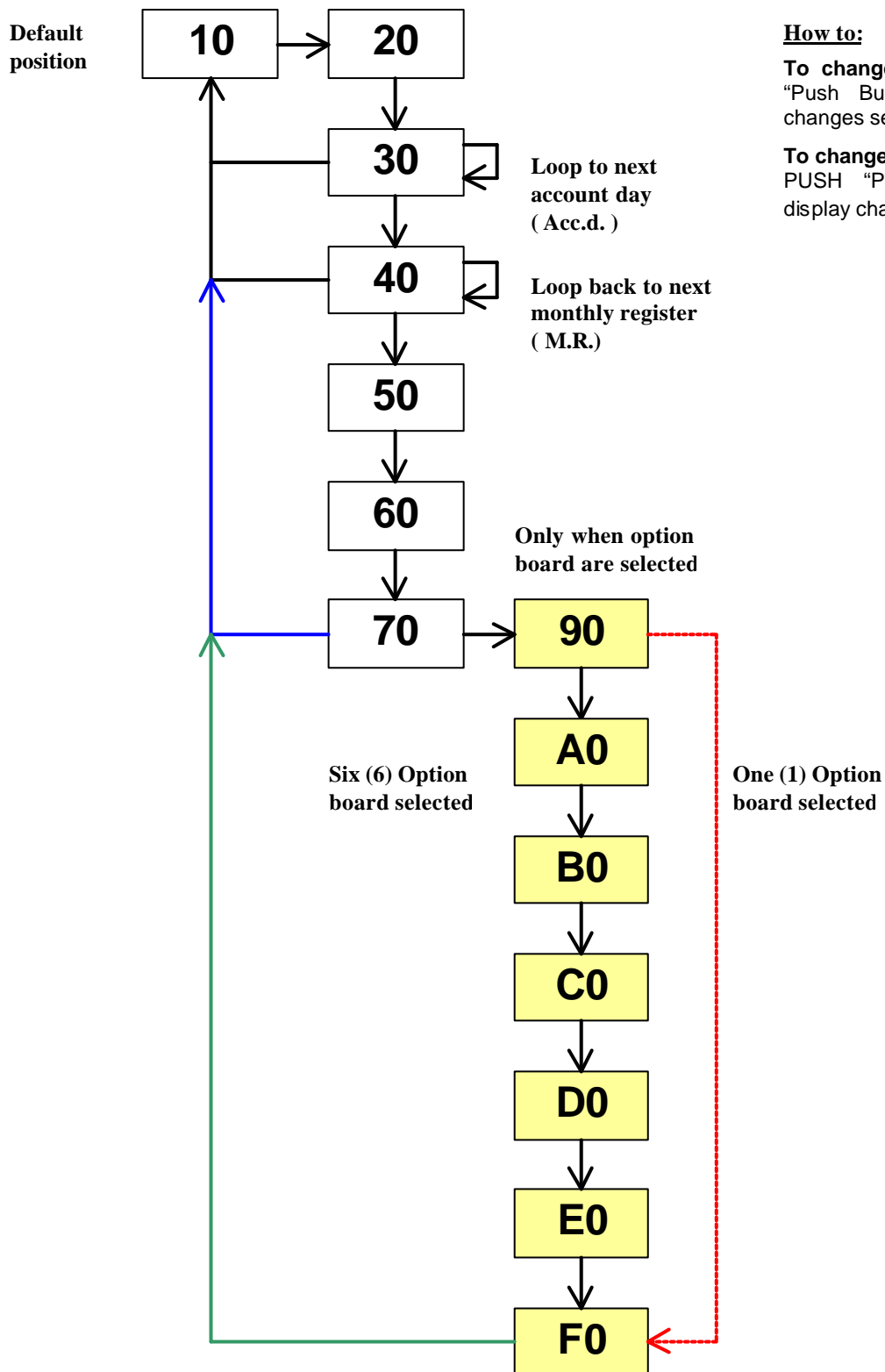
Table 3.2b, Display sequence normal mode

- 1 F2/F3/F4 have two registers for accumulated volume. Value 11, is incremented at the rate of arrived flow pulses. The other register, value 70 is incremented in conjunction with energy calculation.
- 2 In order to change to the next account day, keep the button pressed until the date starts to increment, then release the button. After the display 37, see table above, the next account day will display. **Note:** If the "Push Button" is pressed once again the display reverts to default position.
- 3 To change to another month keep the button pressed until the date starts to increment. Release at the requisite month. After display 47, see above, the next stored date will be displayed. **Note:** If the Push Button is pressed again the, display reverts to default position.
- 4 Meter numbers are indicated with an "A" in the left hand sequence digit. The right hand sequence digit, indicated with X in the table above shows the first digit in the meter number.

### 3.3.5.3 Display sequence normal mode (summary)

- 10 - Readout Values 1 ( Power, flow)
- 20 - Readout Values 2 (Temperature, momentary values)
- 30 - Account days values ( Acc.d. )
- 40 - Monthly registers (M.R.)
- 50 - Date registers
- 60 - Communication, Settings
- 70 - Volume check, error listings
- 90 - Option Board status
- A0 - F0 Option Board sequences

### 3.3.5.4 Display sequence normal mode schematics



**How to:**

**To change sequence** HOLD the "Push Button" until the display changes sequence

**To change values** within sequence PUSH "Push Button" until the display changes value.

Fig 3.8, Display schematics for "normal mode"

### 3.4 Error codes

Sometimes an error code will appear in display sequence 15, 37, 47, 74 and on M-Bus. These codes consist of three (3) hexadecimal (Hex) digits, e.g. 0 – 15. The error can be combined by the values explained below.

**Example :** 0000005 = 1 + 4 = error 1 and error 4, Temperature sensors disconnected.

Display <b>digit 1</b> first	1	Low Temp. sensor disconnected
	2	Low Temp. sensor short circuit
	4	High Temp. sensor disconnected
	8	High Temp. sensor short circuit
Display <b>digit 2</b> second	1	EEPROM Error
	2	I2c Error
	4	Low Flow
	8	Alarm input low
Display <b>digit 3</b> third	1	Battery expire
	2	Oscillator error
	4	Pulse input too long
	8	Not in use

Table 3.3 Error code numbers

A good help to is to use the table below to find out which error the meter displays

**Example:** 0000045

First digit 5 = Errors 4 + Error 1 = Temperature sensors disconnected  
Second digit 4 = Error 4 = Low Flow Error

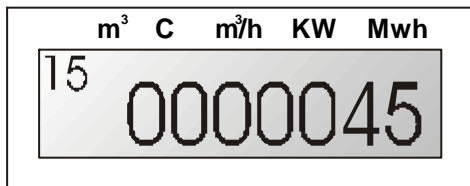


Fig 3.10, Display error at Sequence 15  
First digit 5, Second digit 4

No.		Error number (s)
Hex.	Dec.	
0	0	0
1	1	1
2	2	2
3	3	1 + 2
4	4	4
5	5	4 + 1
6	6	4 + 2
7	7	4 + 2 + 1
8	8	8
9	9	8 + 1
A	10	8 + 2
B	11	8 + 2 + 1
C	12	8 + 4
D	13	8 + 4 + 1
E	14	8 + 4 + 2
F	15	8 + 4 + 2 + 1

## 4 Seals, meter protection

The F2/F3/F4 are tampering protected with seals. To enter the meter or to enter “Test Mode”, “Service Mode” or to enter the meter several seals need to be broken. See placement of the seals below

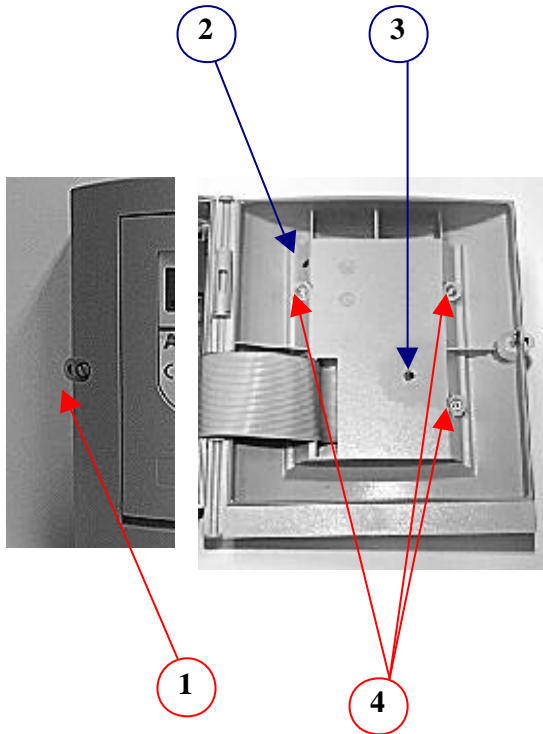


Fig 4.1, Placement of seals F3/F4

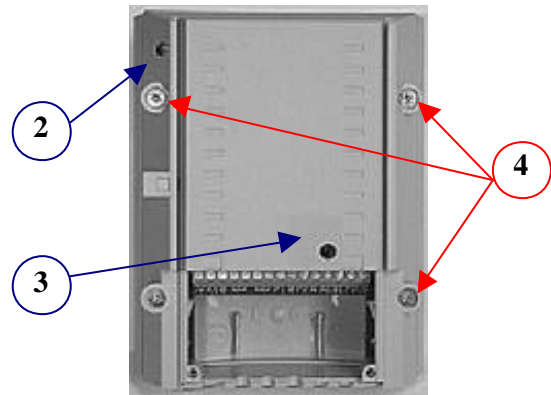


Fig 4.1, F2 Placement of seals

### Seals

1. Installation seal, protecting the installation from tampering
2. Service seal, protection from entering the service mode.
3. Test seal, protection from entering and program the meter.
4. Factory seal, the electronics protection

### 4.1 Volume check

The F2/F3/F4 have an extra volume check, the meter calculates two different volumes :

- Volume from flow sensor  
( Display sequence 11)
- Volume calculated from energy increment register.  
( Display sequence 70)

This function prevents tampering of flow pulses programmed in meter and acts as an extra check. Normally there is a small difference between these two registers.

# 5 Connecting the meter / Handling

The figure below shows the main circuit board of F4. The “2” indicates main circuit board for F4.

**Note:** Only option boards marked with “2” can be used with F4 heat meter.

## 5.1 Circuit board F4

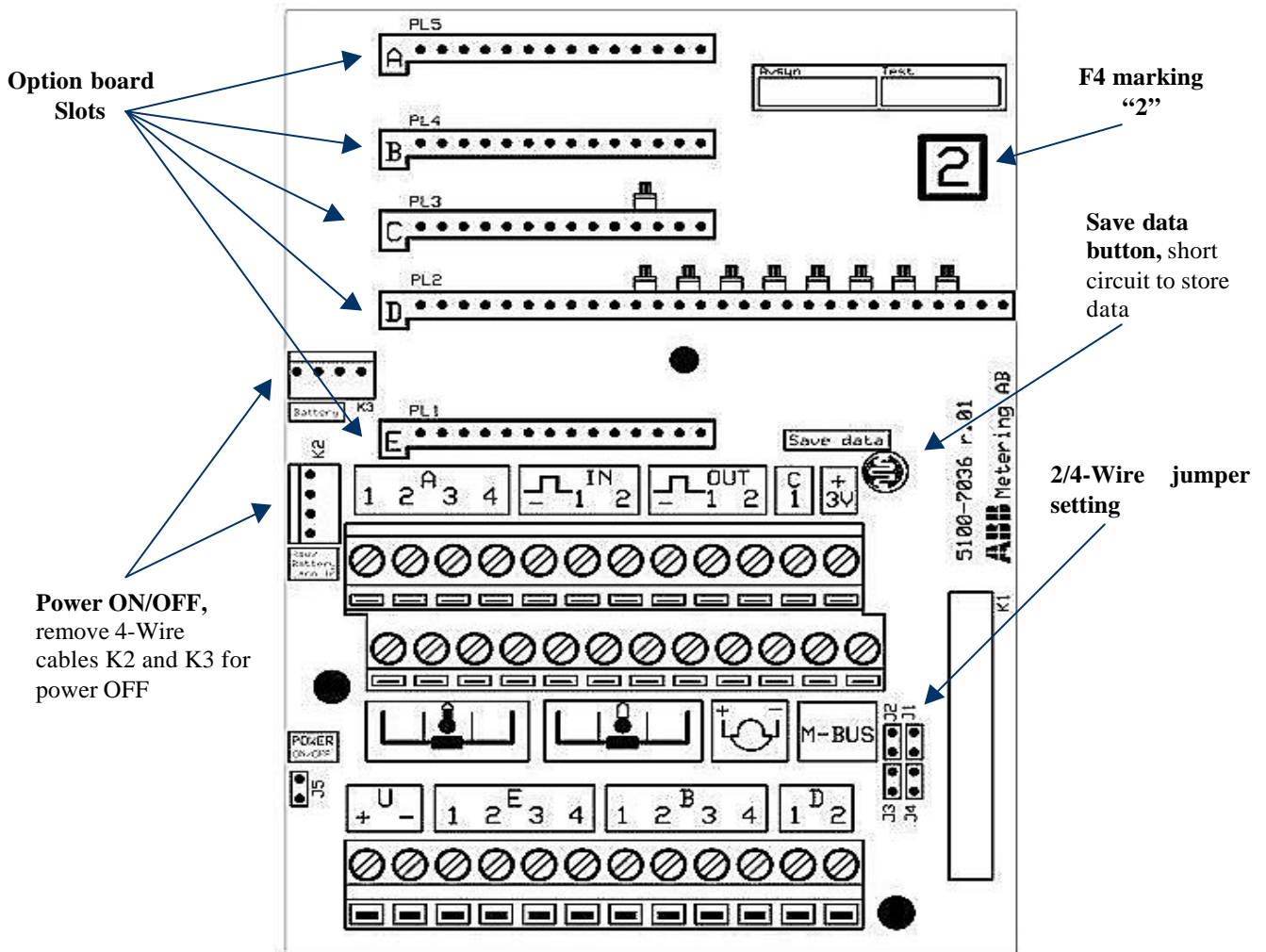


Fig 5.1, Main circuit board for F4

## 5.2 Connection terminals

### 5.2.1 Sensors and M-Bus connection

The connection of temperature sensors are shown in figure 5.2 and table 5.1, according to EN1434.

**Warning:** Do not connect the M-Bus to the wrong terminal or the meter can be seriously damaged when the M-Bus loop is powered.

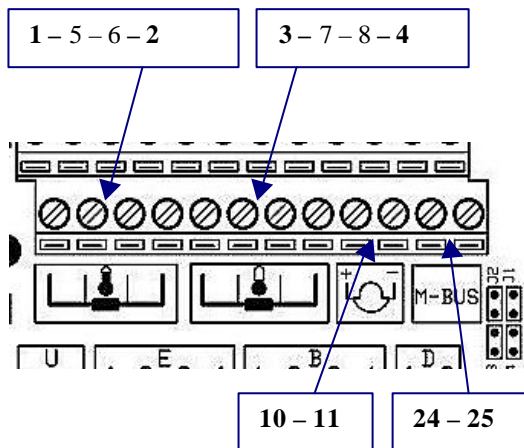


Fig 5.2, Numbering of terminal according to EN1434, ( numbering from left to right ).

#### 5.2.1.1 EN1434 terminal table

Terminal no.	Signal description
1	High temp. sensor*
2	High temp. sensor*
3	Low temp. sensor*
4	Low temp. sensor*
5	High temp. sensor
6	High temp. sensor
7	Low temp. sensor
8	Low temp. sensor
10	Flow sensor signal input (+)
11	Flow sensor signal input (-)
16	Pulse 1 output (+)
17	Pulse 1 output (-)
18	Pulse 2 output (+)
19	Pulse 2 output (-)
24	M-Bus interface
25	M-Bus interface

Table 5.1, terminal connection according to EN1434

\* Only for 4-Wire connection

### 5.2.2 Pulse input connection

The meter is constructed to accumulate pulses from for example other meters, such as electricity meters, cold and warm water meters and gas meters.

Pulse input shall be connected to the terminal marked IN. The pulse input shall be connected to outputs of the type “Open Collector”.

**Pulse input 1**, connect “+” to “IN 1” and “-“ to “IN-“

**Pulse input 2**, connect “+” to “IN 2” and “-“ to “IN-“

#### Specification input :

Min pulse duration 250ms (12Hz), Voltage: 3V.

### 5.2.3 Pulse output connection

Pulse output is generated from terminal marked OUT. The pulse outputs are of the type “Open Collector”. See also table 5.1 and fig 5.2B.

**Pulse output 1**, connect “+” to “OUT 1” and “-“ to “OUT -“

**Pulse output 2**, connect “+” to “OUT 2” and “-“ to “OUT -“

**Specification** of the outputs are: Max. 30V, Max. 20mA, Pulse duration 250ms.

### 5.2.4 Alarm output connection

The F4 meter is equipped with one Alarm output. The alarm outputs output one pulse every hour as long as an alarm exists the meter. The alarm output can be configured in the Service Program version 2 for F4.

The alarm output shall be connected to the terminal marked D. The alarm output is of the type “Open Collector”.

**Alarm**, connect “+” to “D1” and “Ground” to “D2”

#### Specification: Max. 30V,

Max. 20mA, Pulse duration 250ms.

**Note:** the jumpers on slot D must be correctly set according to the marks on circuit board otherwise the Alarm output will not work.

### 5.2.5 Connection 3V/12V

The meter can supply an external device with 3V/12V.

**3V**, connect “+” to “+3V” and “-“ to “IN -“

**12V**, connect “+” to “U +” and “-“ to “IN -“

**Note:** The meter can maximum supply 20mA to other devices.

### 5.2.6 Option board connection

The terminals marked A, B, C, D and E are connection for the option boards, please see documentation for the option boards for more information

### 5.2.7 Potential free output

With an option board the F3/F4 to supply a potential free output, for more information see documentation on potential free option board.

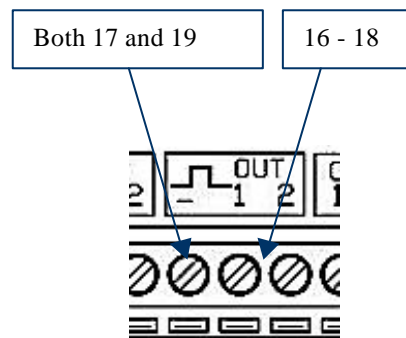


Fig 5.2b, numbering of terminal according to EN1434, ( numbering form left to right).  
(Note: “OUT -“ has numbers 17 and 19)

### 5.3 Battery and mains connection

There are two wires connecting the main circuit board to the power supply boards, Battery K3 and Mains K2, for connection, see fig. 5.3

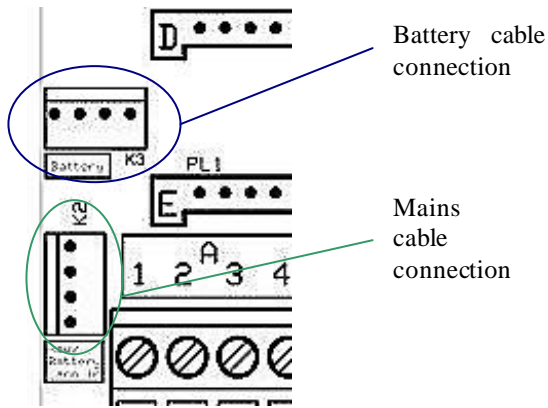


Fig 5.3, Battery and Mains connection

### 5.4 Calculator connection

The main circuit board is connected to the meter K1, see fig 5.4.

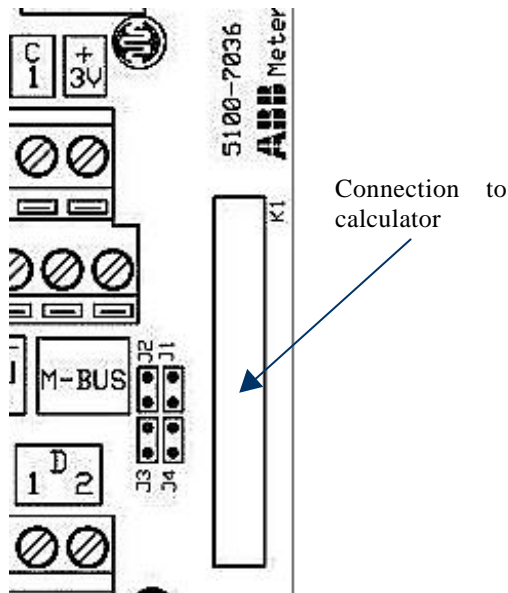


Fig 5.4, Calculator connection

### 5.5 Mains connection and backup battery

The F4 are normally delivered with mains, and backup battery. The backup battery prevents data loss during power failure.

**Connection of mains supply:**  
 Line to terminal marked "L"  
 Neutral to terminal marked "N" and  
 Ground to the terminal marked with "ground symbol",  
 see also below.

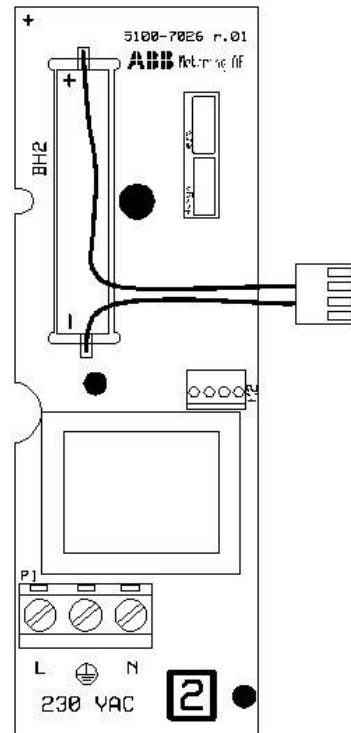


Fig 5.8, connection board mains, with backup battery

## 5.6 Option board handling

Extended functions can be added to the F4 meter by installing option boards.

**Note:** Only option boards with the mark “2” may be used with the F4. See fig. 5.5.

**Note:** Only one (1) option board may be installed at the time, in order for the meter to recognize the option board.

### 5.6.1 Option board installation procedure

1. **Check option board,**  
Marking “2” and which card slot can be used for option board and check correct jumper setting on option board, see table 5.5
2. **Save data,**  
using “save key” to short circuit the “Save data button”
3. **Disconnect flow sensor** connections by removing one flow sensor cable connected to terminal.
4. **Cut power** to main circuit board, remove 4-Wire cables “K2” and “K3” connected to mains
5. **Remove jumpers** on slot (only if required, check with option board manual)
6. **Check DIP switch settings** on option board
7. **Install the option board** carefully, do not bend any terminal pins.
8. **Turn power ON**, by connecting 4-Wire cables “K2” and “K3”.
9. **Check diode “LD1”** on the option board is turned off, this indicates proper installation of option board. Follow the steps 3-9 for installation of additional option boards. Note; only one (1) option board may be installed at the time.
10. **Connect flow sensor**

**Note:** The option board may only be installed in assigned slots, please consult option board documentation for further information.

**Note:** Option board affects battery life expectancy please check with ABB Metering or option board documentation when using a meter only powered by batteries.

### 5.6.2 Dip switch setting of option board

Slot	BY 3	BY 2	BY 1
A			X
B		X	
C		X	X
D	X		
E	X		X
F			
Service	X	X	(X)

Table 5.5, DIP Switch setting of option board for card slots, X – jumper, “ “ – no jumper, (X) – insignificant

Not all option boards can be combined check documentation for more information.

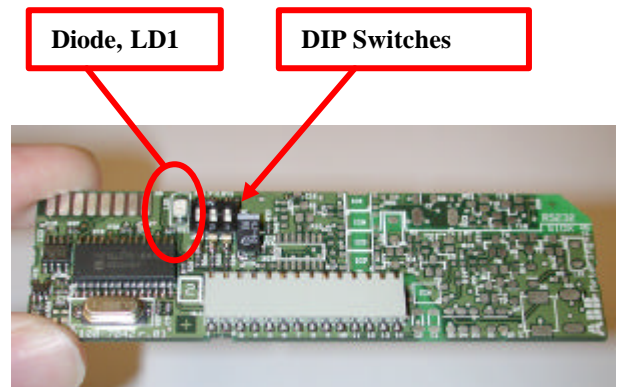


Fig. 5.9., Option board

2

Fig 5.5, Mark “2” for F4 Option Boards

### 5.6.3 Installing additional option boards

Only one option board can be install at the same time. To install next option board follow the steps 2 – 7 in installing option boards.

### 5.6.4 Configure the option board

The option boards can be configured with a service tool without installing the option board into the meter, see also documentation on Plug & Play configuration tool and documentation on option board.

### 5.6.5 Reconfigure option boards

Always when reconfiguration of the option board the option board must be uninstalled. Follow the same procedure for option board as uninstalling the option board. The option board can be reconfigured when installed in the meter.

**Note:** Always uninstall and then reinstall the option boards when reconfiguring the option boards.

### 5.6.6 Uninstall, removal of option boards or reconfiguring option boards

To uninstall or reconfigure one or several option boards all option boards in meter must be removed and the a uninstall procedure must be run. Following procedure to uninstall option boards:

1. **Save data**, using “save key” to short circuit the “save data” button.
2. **Remove flow sensor** connected to meter, by disconnecting one cable connected to meter terminal.
3. **Cut power** to circuit board by removing the 4-Wire cables “K2” and “K3”.
4. **Remove all option boards** installed in meter.
5. **Install the “Uninstall option board”** carefully do not bend any terminal pins.
6. **Turn power ON** by connecting 4-wire cables “K2” and “K3”.
7. **Check “LD1”** diode is lit steady
8. Cut power, remove 4-Wire cables.
9. Remove uninstall board
10. **Install option boards**, see 5.6.1 option board installation procedure.

## 5.7 Cable fittings

The F3/F4 are equipped with cable glands see fig. 5.6.

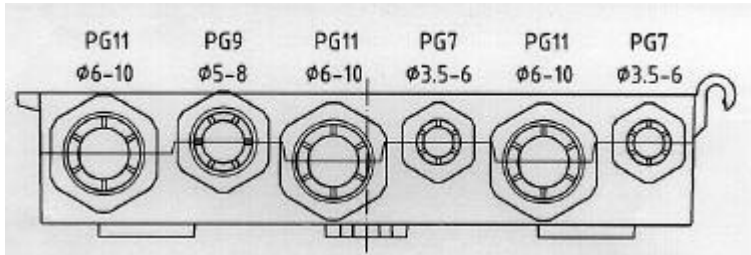


Fig 5.6, Cable fittings F3/F4

## 5.8 Mounting

The F3/F4 are constructed for wall mounting. See fig 5.7.

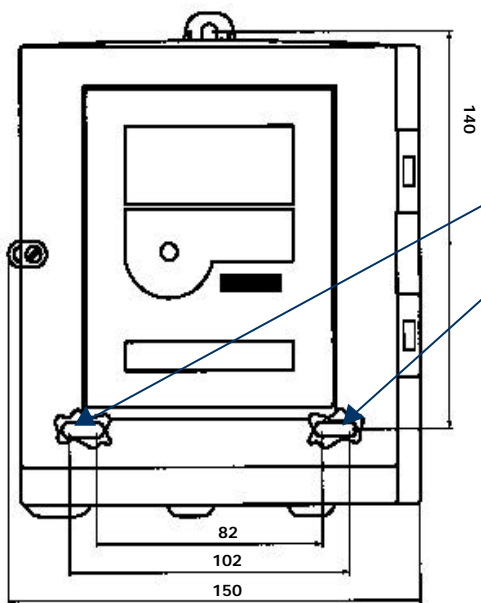


Fig 5.7, F3/F4 Front

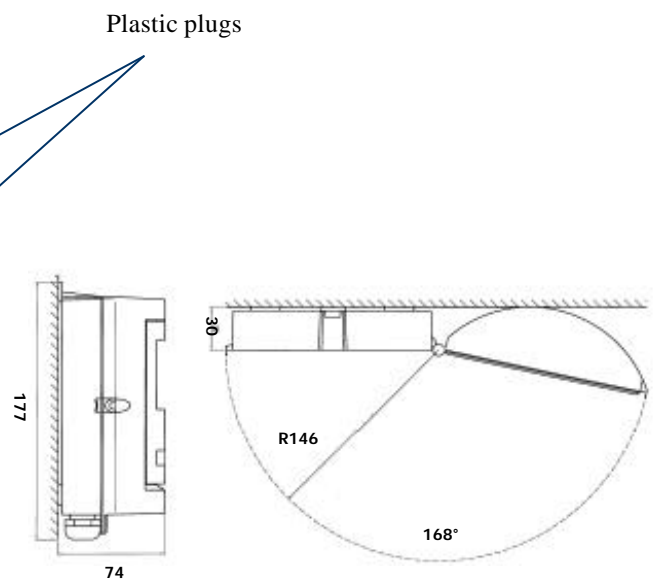


Fig 5.7b, Wall mounting

## 6 Meter measuring

The F4 calculator are in accordance with EN1434:1997, part 1 and 2, measuring and calculating, energy.

The calculator fulfil the requirements for environmental class C, in accordance with EN1434:1997 part 4

### 6.1 Calculation of flow

At each sensor pulse the meter checks time counter against the meter set "average power and flow", then the meter updates it's record. If the time counter, with the resolution 1/128s, is longer than the average time the number of pulses will be stored for next calculation.

The flow calculation can be initialized by M-Bus, OPTO-interface or "Save data" request. The calculation uses the latest store pulse values, if no values have been stored recently the meter uses the most recently stored time pulse plus two seconds.

### 6.2 Calculation of power

The calculated flow, see above is used by the meter to calculate the power and this value is added to the previously stored power values. The power is calculated at each flow pulse or at the maximum time for measurement (normally 60s is set in meter).

### 6.3 Temperature measurement and 4-Wire measurement

The measuring of the temperature sensors is done at each flow pulse or at the maximum time for measurement (normally 60s is set in meter).

If 4-Wire connection is used (default setting in F3/F4), the meter measures both the cable resistance and the temperature sensor resistance. – The meter then corrects the temperature value against the cable resistance.

**Note:** This is only done if 4-Wire connection is set, used in meter.

## 7 Testing, programming & Service

To ensure the functions in the F3/F4 one should perform several tests. Set tests below, “Display test” and “Installation test”

### 7.1 Display test

By selecting display sequence 12 the LCD display can be tested.

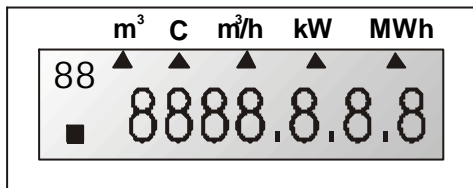


Fig. 3.2, Display test

### 7.2 Installation test

When installing the meter it is necessary to verify that the calculator has been installed correctly. This is very easy to do just follow this procedure:

1. Wait for a flow sensor pulse, check that this pulse results in a symbol for flow sensor pulses in display, see displays. Once the pulse is emitted check display for temperature values display sequence 22 and 23.
2. Check that the real time clock is working properly and time is set correctly.

## 7.3 Service

When meter is in for service there can be a necessity to change the parameter setting within the meter. Some parameters can be changed in the F3/F4 meter without the “Service program version 2.0” Following service procedure is recommended:

1. **Brake the seals, set meter into “Service mode”,** see “Service mode” under display and “Seals” for more information.
2. **Make the changes,** see below for explanation and see “Display, Service mode” for display sequence.
3. **Exit service mode,** see 1,
4. **Replace the broken seals.**

### 7.3.0 Time

Service sequence, value number : “00”

The time is shown in “HHMM” where the two digits “HH” is hour with two digits, and “MM” is minutes with two digits.

### 7.3.1 Date

Service sequence, value number : “01”

The time format is “YYMMDD”, where, “YY”=Years, “MM”=Months and “DD”=Days.

### 7.3.2 Pulse value

Service sequence, value number :

“02”, pulse value and

“03”, decimal setting for pulse value.

The pulse value are always displayed with four (4) digits, in Service sequence, value number “02”. The decimal setting in Service sequence, value number “03”.

**Example:** “02” displays 2500 and “03” displays 3.  
Pulse value : 2.5 l/p

### 7.3.4 Account days

The F4 have to account days at service sequence, value number :

“04”, Account day 1

“05”, Account day 2.

The format is “MMDD”, “MM”= Months, “DD”= Days.

If the “MMDD” is set to “0000” the meter will not store account days.

### 7.3.6 Communication address

Service sequence, value number : “06” is to set primary communication address. The communication address is always set with three (3) digits.

**Example,** address 5 on display: 005

### 7.3.8 Placement of flow sensor placing

Service sequence, value number : “08” is for setting placement of flow sensor. Format 1 or 0. Where:

1. = Flow sensor installed in return (cold) end of pipe
2. = Flow sensor installed in forward (hot) end of pipe.

### 7.3.9 Recommended date for battery replacement

Service sequence, value number : “09” displays recommended date for battery replacement. The format is “YYMMDD”. Where “YY” = Years, “MM”=Months, “DD”= Days.

### 7.3.A Return to normal mode

Service sequence, value number : “0A” displays return to normal mode. When value is set to 1 the meter exits the service mode when leaving “0A” sequence.

## 7.4 Verifying the meter

Verification of the meter's measurement accuracy is undertaken in the test mode, where the energy value/flow sensor pulse is issued via the HF-output at the service adapter. For each flow sensor pulse, measurement takes place on the temperature sensors and a pulse burst corresponding to the measured energy of the meter is issued.

To test (verify) the measurement accuracy of the meter by means help of HF-pulses proceed as follows:

1. While short circuiting the test button with "Test key", see fig. 2.2, hold the "Push Button", until the display mode changes.
2. The calculator now enters test mode. This is indicated by a special symbol being displayed.
3. Connect fixed resistance for simulation of Pt100 via terminal block units Nos. 5-6 (flow) and 7-8 (return).
4. Connect a pulse generator via terminal block unit Nos. 10-11 (connection 11 is ground) in order to simulate flow sensor pulses. Note: Voltage level is max. 3V.
5. Connect an OPTO-head/ interface with HF-pulse interface at the front.
6. Simulate a flow sensor pulse after which the meter issues an (approximately) 20 kHz pulse burst corresponding to  $100 \cdot k \cdot dt$  pulses via the HF-output.  $k$  is the energy factor. ( $\text{kWh}/^\circ\text{C}/\text{m}^3$ ) and  $dt$  is the difference between simulated flow and return temperatures.  
**Example:**  $R_f=138.50\Omega$  ( $100.00^\circ\text{C}$ ),  
 $R_r=127.07\Omega$  ( $70.00^\circ\text{C}$ )  $\Rightarrow dt=30.00^\circ\text{C}$ ,  
 $k=1.141$  gives  $100 \cdot 1.141 \cdot 30 = 3423$  pulses.
7. The next flow sensor pulse can be sent immediately after the HF-pulse burst from the meter has been dispatched.

To leave test mode proceed as follows:

1. While the short circuit the test button hold the "Display Button", see fig.2.2.
2. The calculator now enters *operation mode*.

To verify (test) the measurement accuracy of the meter with the help of the display, first set up connections in accordance with points 3 and 4 above for testing by means of HF-pulses. Testing is undertaken in the meter's operation mode. Proceed as follows:

1. Supply flow sensor pulses until the energy display is incremented one step.
2. Supply flow sensor pulses with a maximum frequency of 12 Hz until the display has been stepped appropriate numbers of steps.
3. Errors in testing decrease with the number of steps made during the test. If the meter is programmed for 1.0 litre/pulse and resolution for display of energy is 0.001 MWh, this means that 10 steps on the display correspond to 288.85 pulses from the flow sensor with selected temperatures in accordance with the above. The testing error is maximum + - 1 pulse, which, in the example, corresponds to 0.35%.

## 8 Technical data

### 8.1 Data output table

Following data is accessible via the data output:

Data	EN 60870-5	Manufac ture Specifi c	SIOX (Option al)
Flow sensor placing	X		X
Program version	X		X <sup>5</sup>
Manufacturer	X		
Communication address	X		X
Meter number	X		
Error code (limited)	X		X
Accumulated energy	X		X
Accumulated, volume 1 <sup>1</sup>	X		X
Accumulated, volume 2 <sup>2</sup>	X		
Flow temperature (high)	X		X
Return temperature (low)	X		X
Temperature difference	X		X
"Operation Time" (operation time error time)	X		
Momentary flow	X		X
Momentary power	X		X
Time and date	X		
Pulse register for pulse input 1	X		
Pulse register for pulse input 2	X		
Monthly values <sup>3</sup> data storage	X		
Monthly values <sup>3</sup> accumulated energy	X		
Monthly values <sup>3</sup> accumulated volume 1 <sup>1</sup>	X		
Monthly values <sup>3</sup> accumulated volume 2 <sup>2</sup>	X		
Account days same as monthly values, see above	X		
High resolution energy		X	X
High resolution volume 1 <sup>1</sup>		X	X
High resolution volume 2 <sup>2</sup>		X	
Relevant error code		X	
Accumulated time for relevant error		X	
Previous error code		X	X <sup>6</sup>
Previous accumulated time for relevant error		X	
Manufacturing number		X	
Pulse value		X	
Latest read energy via communication		X	
Time [h] since latest reading		X	
Recommended date for battery replacement			
Error codes and accumulated error times during storage (see monthly registers and account days above)			

Table 8.1, Data output

1. as per flow sensor
2. corresponding to energy registers
3. 37 registers
4. -
5. For being compatible towards existing system, the version number is fictitiously set to four.
6. Total error time

## 8.2 Power supply

Battery	3.6V - 2.750Ah or 3.6V - 2x 2.750Ah Operation time max. 10 years
Mains	230V±10%, 45-65Hz, battery 2.750 Ah as a spare

Table 8.2, Power supply

Voltage drop, if voltage drop occurs during operation the meter goes to working on it's spare battery.

## 8.3 Temperature sensors

Approved and matching pares type PT100 or PT500 are to be used.

Maximum sensor current (RMS): 4µA for PT100

Cable area [mm <sup>2</sup> ]	Maximum cable length for PT100 sensors [m]
0.22	2.5
0.50	5.0
0.75	7.5
1.50	15.0

Table 8.3, Cable areas for PT100

## 8.4 Flow sensors

Flow sensors with pulse output.

Frequency Max. [Hz]	12 Hz
Pulse Value [l/p]	0.0001-9999
Pulse Length Min. [ms]	40
Voltage Max. [V]	3
Cable length Max. [m]	15

Table 8.4, Flow sensor specifics

## 8.5 Temperature ranges

Temperature range	0 - 190°C
Temperature difference	2 - 120K

Table 8.5, Temperature ranges

## 8.6 Ambient temperature & Temperature class

F2/F3/F4 comply with the prerequisites for Environmental Class C according to EN1434.

Ambient temperature Storage/Transport	-20°C to +70°C
Ambient temperature Operation	+5°C to +55°C

Table 8.6, Ambient temperature ranges.

## 8.7 Flow sensor placing

F2/F3/F4 can be configured for flow sensor placed in warm or cold pipe.

## 8.8 Maximum values for power

The values below are valid for energy unit [MWh] and standard decimal setting.

Pulse values [l/p]	Maximum power [ MW ]
1.0	3.3
10.0	33.0
100.0	330.0
2.5	3.3
25.0	33.0
250.0	330.0

Table 8.8, Max. Power / Pulse values

## 8.9 Dynamic behavior

Measurements are undertaken for each flow sensor pulse, provided the time between the pulses is five (5) seconds or longer. If the time between pulses is less than five seconds, measurement takes place each five seconds. When the period between the flow sensor pulses exceeds 60 seconds, a measurement takes place every 60th second. For this measurement only the temperature is updated.

## 8.10 Data output interfaces

M-Bus acc. to EN1434-3	OPTO-interface (EN60870-5) and bus connection (terminal)
SIOX	Option Board, bus connection (terminal)
LonWorks	External interface

Table 8.10, Data output interfaces

## 8.11 Pulse outputs

F3/F4 are equipped with two pulse outputs as standard of the type "Open collector" for energy (Pulse output 1) and volume (Pulse output 2). If relay is required an Option Board is required.

**Pulse output 1**, energy, one (1) pulse per display update in the energy register ( seq. "10" ).

**Pulse output 2**, Flow, one (1) pulse per display update in the flow register (seq. "11" ).

Pulse duration	[ms]	250
Max. Voltage	[V]	30
Max. current	[mA]	20

Table 8.11, Pulse output data

## 8.12 Pulse inputs

F3/F4 are equipped with two pulse inputs as standard. The pulse inputs can be used for measuring of other meter with pulse outputs, such as cold- and hot water meters, gas, electricity meters and other meters.

The pulse inputs are constructed as volume registers. These registers accumulate the pulses into two volume registers with the value [m<sup>3</sup>].

Frequency	[Hz]	12
Min. Pulse duration	[ms]	40
Max. Voltage	[V]	3

Table 8.12, Pulse output data

## 8.13 Alarm output

The F4 is equipped with one alarm output as standard of the type "Open collector". The alarm output sends a pulse every hour as long as an error code exists.

Alarm frequency when an error exists	Once every hour
Pulse length	[ms] 250

© ABB Metering AB

Kista, Sweden

**Date :** 2000-10-11

Created by: JT

Rev. date 2001-01-03

Rev. by: JT

Filename : F4 Manual [3-4-01 ME].doc

Revision no.: 1.02

