MC100
Pump Control Module

User's Manual
(Profibus DP)

CONTENTS:

1 Introduction 4
1.1 Terms used in this manual 4
1.2 Precautions 4
2 General description of MC100 5
2.1 Overview 5
2.2 Introduction & design purpose 5
2.2.1 How it works / Technical description of operation 5
2.3 Flexicon pumps used in multi-filling system, short description 6
2.4 How to operate the dispenser pumps 7
2.5 Communication on the Profibus 7
3 Technical specifications 8
3.1 Dimensions 8
3.2 Specifications 9
3.3 Unpacking and inspection of MC100 10
3.3.1 Identifying the module 10
3.3.2 Identifying the parts 11
3.4 Mounting 11
3.4.1 Choosing a place to mount the MC100 11
4 Wiring 12
5 Fieldbus network node address and front plate indicators 14
5.1 Network node address switches S1/S2: 14
5.2 P1/P2 LED indicators: 14
5.3 Display P4/P5 15
5.3.1 Start up states 15
5.3.2 Network address 15
5.3.3 Alarm- and warning display 15
5.3.4 Dipswitch 15
6 Configuring the fieldbus network to the MC100 16
6.1 Connecting the MC100 and the pumps for the first time 16
6.2 Configuring to the Profibus DP network 16
7 Operating the MC100 17
7.1 Process Data Exchange (Cyclic data) 17
7.1.1 Structure of the data package sent to and received from the MC100 17
7.1.2 Process control bits – word 0 (PLC → MC100) 20
7.1.3 Process status bits (MC100 → PLC) 22
7.1.4 Process control bits for the pumps– word 1 to 9 (PLC → MC100) 23
7.1.5 Process status bits from the pumps – word 1 to 9 (MC100 → PLC) 24
7.2 Operation Parameters/Parameter specifications 25
7.2.1 List of basic parameters 25
7.2.2 Control Data Word - data word 10 (PLC → MC100) 27
7.2.3 Status words from parameters transfer (MC100 → PLC) 28
7.2.4 Data word 11 28
7.2.5 Alarm and warning (MC100 → PLC) 28
7.3 Examples: 29
7.3.1 New speed to pump 1: 29
7.3.2 New calibration value to pump 3: 30
8 Alarm and warnings 32
8.1 Alarms handling 32
8.1.1 Module alarms 32
8.1.2 Pump alarms 32
8.2 Warnings handling 33

8.2.1 Warnings 33
9 Trouble shooting 34
9.1 Trouble-shooting 34
9.2 Opening the MC100 for service/replacement of PCB's 35
10 Decommissioning 36
10.1 Advice about dismantling / removal / disposal 36
10.2 Environmental conditions / -regulations 36
10.3 The WEEE system 36
11 Appendix 1 37
12 Appendix 2 38
12.1 Tube tables 38
12.2 Volume, Speed and acceleration 39
12.2.1 PD12 39
12.2.2 PD22 39
12.2.3 GD30 39
13 Declaration of Conformity 40

1 Introduction

1.1 Terms used in this manual

Fieldbus	DeviceNet, Profibus.
Fieldbus interface module	Anybus Compact Com Module from HMS Industrial Networks AB
Filling system	a MC100 and up to 16 pumps
Pump	Any Watson-Marlow Flexicon pump communicating on FlexNet (PDxx, GDxx, DDxx)
WMF	Watson-Marlow Flexicon

1.2 Precautions

This manual should be read thoroughly before using the MC100.

It is strongly advised that no wiring is connected or disconnected on the MC100 while power supply is turned ON

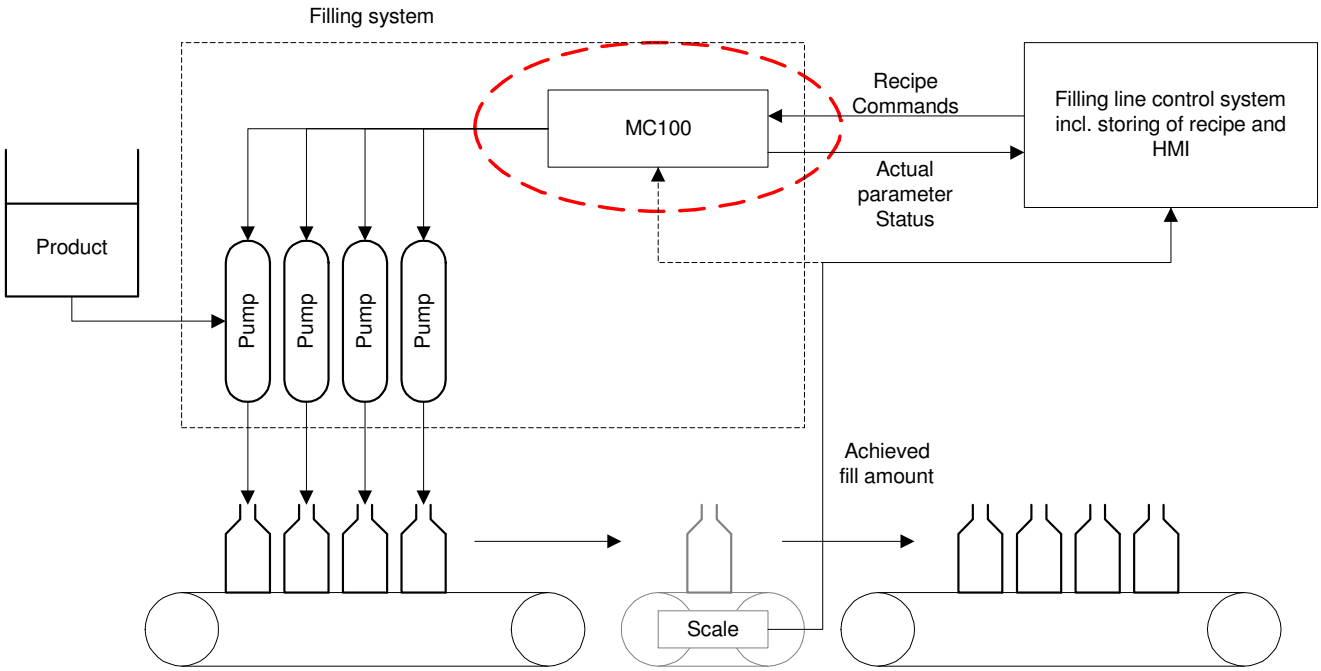
2 General description of MC100

2.1 Overview

MC100 is a pump control module for controlling up to 16 WMF Pumps. The basic function is

- to receive filling data from the filling line control system through an industrial fieldbus
- based on data received from the filling line control system to calculate operating values for the pumps
- to transmit data to the pumps connected to the MC 100 via FlexNet
- to receive data from the pumps connected to the MC 100 via FlexNet
- to transmit the pump data to the filling line control system

MC100 constitutes together with WMF pumps a filling system designed for incorporation into a larger filling line as described below.



2.2 Introduction & design purpose

The MC100 is a small module for mounting inside the control cabinet of the filling line.
It is designed with the purpose of integrating Watson-Marlow Flexicon pumps into a filling line.

2.2.1 How it works / Technical description of operation

Via the fieldbus the MC100 receives operating data from and sending data to the control system for the filling line. The data are divided in three types:

- General data for the pump system
- Set-up data for each pump
- Operation data for each pump

The MC100 sets up the pump system according to the data received from the control system for the filling line.
All control and status signals for the individual pumps connected to the MC100 are sent to the MC100 via the fieldbus. The dispensing can also be controlled via hardwired signals. Please see the manual for the pumps for more details regarding the hardwired signals.

The MC100 cannot store data such as recipes and historical data. These data must be stores in the control system for the filling line and be transmitted to the pump system when needed.

2.3 Flexicon pumps used in multi-filling system, short description.

The Watson Marlow Flexicon multi filling system consists of up to 16 filling dispensers (pumps) connected via a fieldbus to a MC controller.
The dispensers can be peristaltic dispenser pumps (PD12 and PD22) and gear dispenser pumps (GD30).
The MC controller can be either a MC12 controller with integrated keyboard and display to enter data and control the dispensing or MC100 for integration in control systems.
This manual describes the MC100 controller.

The pumps are used for dispensing accurate doses of liquid into vials.
For this purpose there are a number of parameters, which are used to control the pump:

Speed:	The range for the dispensing speed is 30 to 600 rpm depending on the pump and the tube selected
Acceleration:	The range is 1 to 200 rpm/s depending on the pump and the tube selected.
Reverse (back sucking):	Is a figure between 1 and 10 defining a short reverse pumping to prevent dripping after the dispensing.
Tube:	The pumps hold a tube table of up to 10 tubes, which can be read from the pumps. The tubes are depending on the pump type. Thus the pump table can be down loaded from the pump software via the MC100.
Volume:	The volume the pump has to dispense at each filling. Please also see serial and parallel mode below.
Density:	The density [g/cm^3] for the product to be filled. Used when calculating the calibration value.
Calibration:	The net weight filled during dispensing. When a new volume is defined for a pump it will dispense approximately 70 – 80% of this volume until calibrated. The calibration is normally done by tare weighing a vial, filling it and weighing it again to calculate the net filling weight. The net weight filled is sent to the MC100. The MC 100 then calculates the dispensing data and sends it to the pump in question. Please see the manual for the pump for further details.

When more than 1 pump is connected to the MC100, it is possible to operate the filling system (MC 100 with pumps) in 3 different operating modes: Individual, parallel and serial mode.

Individual mode:	All the different types of WM-Flexicon pumps can be connected and run independently for all parameters.
Parallel mode:	This mode requires that all enabled pump are of the same type, i.e. all PD12; all PD22 or all GD30. Different pump types can be connected to the MC 100, but only pumps of the same type can be enabled and operated together in parallel mode.

	In parallel mode a virtual pump (pump no. 0) is be used to hold common parameters for all the enabled pumps. However, the pumps will still have to be calibrated individually.
Serial mode:	This mode requires that all enabled pump are of the same type, i.e. all PD12; all PD22 or all GD30. Different pump type can be connected to the MC 100, but only pumps of the same type can be enabled and operated together in parallel mode. All pump data, except tube sizes, are stored in the virtual pump (pump no. 0). The filling volume is divided to the pumps based on the tube sizes. Calibration for all the pumps is done by calibrating the virtual pump 0.

2.4 How to operate the dispenser pumps

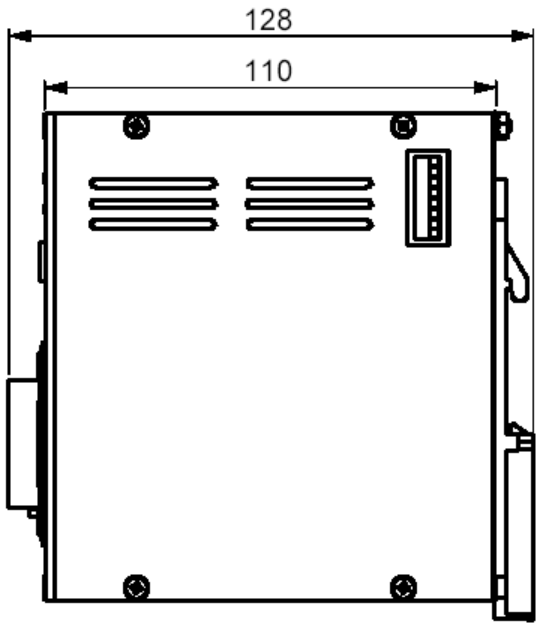
Before a new filling is started the parameters for this filling is loaded to the pumps from the filling system.
The data are loaded to the pumps either individually or as common data depending on the operating mode – please see above.
Initially the pumps need to be primed – i.e. the product has to be filled into the tubes and nozzles of the filling system.
Hereafter the pumps must be calibrated.
For details of priming and calibrating please see the manual for the pumps attached.
During production a regularly re-calibration may be necessary – e.g. for each 1.000 filling depending on the product to be filled. This can be done “on the fly”.
For details on how to send and receive data from the MC100 please see section 7.

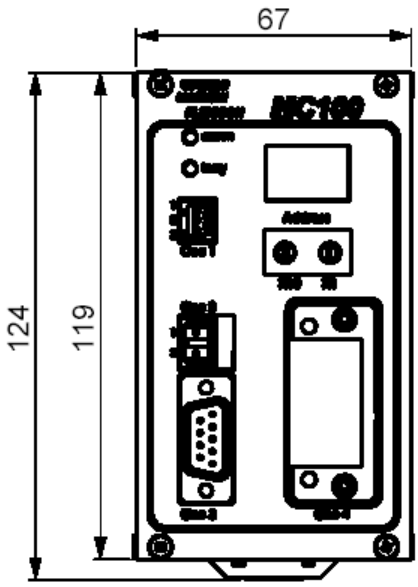
2.5 Communication on the Profibus

The communication between the MC100 and the PLC system for the filling line runs continuously.
Changes in status of the pumps and commands to the MC100 and attached pumps are communicated when required.
To send new data to the MC100 and the attached pumps the data are sent using a 23 data words telegram. The details of this telegram are described in section 7.

3 Technical specifications

3.1 Dimensions





3.2 Specifications

Fieldbus:
- Profibus DP-V1

Pumps:
Up to 16 pumps can be connected to and controlled by one MC100.
The pumps must be able communicate with MC100 via FlexNet protocol.

Material and surface treatment:
- Mounting box made from aluminium.
- All aluminium parts anodised (conductive).

Environmental:
- Ingress protection according to IP30.
- NEMA 1 enclosure.

Mounting:
- MC100 is to be mounted on DIN rail size 35.

Power supply:
- Supply 24 VDC ± 10%.
- Power consumption less than 10 VA.
- Fuse max. 1A

Weight:
- 0.5 kg.

3.3 Unpacking and inspection of MC100

The MC100 is delivered with

- The MC100
- Declaration of Conformity
- CD-ROM with documentation:
  - Manual for installation, programming and service of MC100
  - Documentation and support-files for Anybus Compact Com fieldbus module
  - Function blocks for Siemens Step7
  - GDS file for Siemens Step7

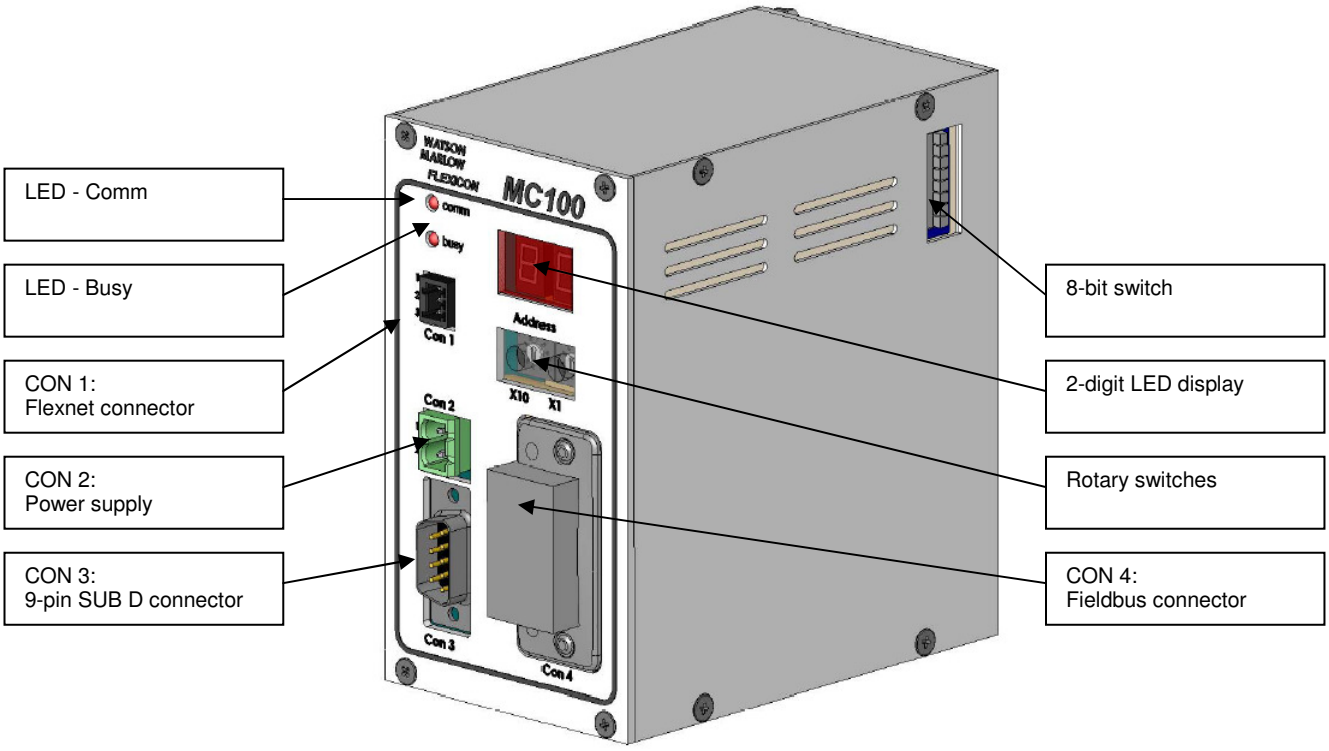
The latest revision of this manual and of the function blocks can be downloaded from our Internet site at wmflexicon.dk.
Please check that all ordered items have been received and that no items were damaged during transport. In case of any defects or omissions, please contact WMF or your supplier immediately.

Please verify that the model number stated on the nameplate and the installed fieldbus connector matches your purchase order.

Model number on nameplate	Fieldbus connector
MC100 61-120-000	Profibus DP-V1

3.3.1 Identifying the module

MC100 module:



3.3.2 Identifying the parts

- MC100 module.
- Connector for FlexNet.
- Connector for Power Supply.
- Connector for Fieldbus.

3.4 Mounting

3.4.1 Choosing a place to mount the MC100

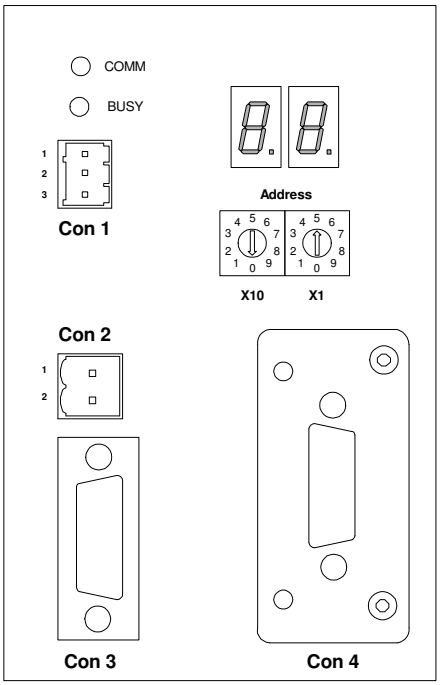
The MC100 must be mounted in an environment that adheres to the specifications in 3.2.

The MC100 must be protected from the following conditions
- Rain and moistures
- Corrosive gasses
- Dust or metallic particles in the air
- Physical shock or vibration
- Magnetic noise (e.g. welding machines, power devices, etc.)

On the left side of the module is a dipswitch (se 3.1), which should be accessible.

4 Wiring

MC100 Frontplate



Connectors / Indicators / Switches

Con1	FlexNet		Connector	Connect with
1	/DATA	I/O	PHOENIX MC 0,5/ 3 –G-2,5THT	PHOENIX FK MC 0,5/ 3 –ST 2,5
2	GND	-		
3	DATA	I/O		

The FlexNet connector should be connected to the corresponding terminals on all the pumps, establishing a multidrop network and the last pump should be terminated with a 120 ohm resistor between DATA and /DATA.
Use 0.25 – 0.35 mm2 wires twisted or screened. Terminal tubes must be minimum 8 mm long.

Con2	Power Supply		Connector	Connect with
1	+24V	IN	PHOENIX MC 0,5/ 4 –G-2,5THT	PHOENIX FK MC 0,5/ 3 –ST 2,5
2	0V	IN		

Use 0.5 mm2 wires, terminal tubes must be minimum 8 mm long.

Con3	Communication		Connector	Connect with
1	RS485 – A	I/O	9 pole SubD Male	Crossed cable to for example PC
2	TxD	OUT		
3	RxD	IN		
4	N.C.			
5	GND	-		
6	NC			
7	CTS	OUT		
8	RTS	IN		
9	RS485 – B	I/O		

Con4	Fieldbus Interface	Profibus DP	9-pole SubD Female
1	-	-	
2	-	-	
3	B Line	Positive RxD/TxD RS485 Level	
4	RTS		
5	GND Bus		
6	+5V Bus output	Max. 10 mA	
7	-	-	
8	A Line	Negative RxD/TxD RS485 Level	
9	-	-	
Housing	Cable Shield	Internally connected to protective shield	

5 Fieldbus network node address and front plate indicators

5.1 Network node address switches S1/S2:

The node address is setup on the 2 rotary switches S1 and S2.

Address-range 1 to 99

The address is normally set before powering up and connecting to the network for the first time, but if the address is change after power up, the new address will flash on P4/P5 display for 5 seconds, during which it is possible to change back to the old address.
After the 5 seconds the MC100 will do a total factory reset and start up using the new address.

5.2 P1/P2 LED indicators:

P1	Green	Continuously ON or flashing indication communication with the pumps
	Red	Flashing indicates Lost connection to at least 1 pump or internal error
P2	Green	Currently not used
	Red	ON indicates at least 1 pump is active
		Flashing together with P1 indicate fatal internal error in the module.

5.3 Display P4/P5

This display is used for general indication of the start up states in the MC100 and for various other purposes.

5.3.1 Start up states

P4/P5	Description	Note
S U	Initial start up state	
S.U.	Internal communications started	
S.0.	Start initialisation of the fieldbus module	Short state if no errors
S.1.	Cyclic data now exchangeable with the network	Short state if no errors
S.2.	MC100 ready and waiting for connection	
S.3.	Intermediate state / special network state	Short state / idle state
S.4.	Connection to network established and working	Short state
S.5.	Internal error during initialization	Steady state (see trouble shooting)
S.7.	Internal error during initialization	Steady state (see trouble shooting)
S 8	Factory Reset to default	
S 9	Factory Reset to default	

5.3.2 Network address

After initialization, the display is showing the network node address.

5.3.3 Alarm- and warning display

The node address is replaced by a flashing:
AL and the alarm number ***XX,*** when and alarm is present (see **8.1.1** Alarms).
Er and the warning number ***XX***, when a warning (recoverable alarm) is present (see **8.1.2** warnings).

5.3.4 Dipswitch

The dipswitch on the right side of the MC100 module can be used to do a factory-reset function.

Reset state	Dipswitch	Action	Description
0	All OFF	None	Normal runtime state
1	All OFF	Remove power to MC100	
2	SW 8 ON	Apply power to MC100	MC100 starts up and reaches init state 2 And the restart again initializing to factory defaults and starts up.
3	SW 8 ON	Remove power to MC100	
4	SW 8 OFF	Apply power to MC100	MC100 starts up normally

It can be necessary to do a factory reset before connecting the fieldbus network. During the factory reset initialization, the MC100 determines the number and types of pumps connected on the Flexnet. (Please see section 6.x.x).

6 Configuring the fieldbus network to the MC100

6.1 Connecting the MC100 and the pumps for the first time

Make sure all pumps have been giving a unique address and all the pumps have been powered up.
The FlexNet is connected to the MC100 and to the pumps in a multidrop network.

Connect SubD connector X3 to a PC using a NULL-modem cable.
Start a terminal program on the PC for example HyperTerminal.
Set the communication-parameters to: 9600 baud, 8 bits, even parity and 1 stop-bit.

When applying power to the MC100, it will identify itself by printing the line:

" MC100 MFSC Ver. x.yy." (x.yy is the current version)

The MC100 will then try to identify all connected pumps on the Flexnet; the LED indicator X1 will flicker and finally be steady green.

If for example 4 pumps holding address 1, 2, 3 and 4 are detected, the following line will be shown:

"Pumps: 1 2 3 4 1 4 4"

In this example pumps numbered 1-4 are detected, lowest number is 1 and highest number is 4 and there are 4 pumps connected.

If the 2nd line is not printed and the MC12 has an alarm indication: AL01 or AL02 flashing, it must be investigated if the FlexNet is correctly wired.

If everything is OK you continue to configure the Profibus master according to the guidelines from HMS, please see below.

6.2 Configuring to the Profibus DP network

The description how to configure the MC100 for Profibus DP-V1 using Siemens Step7 PLC is described in the HMS document PROFIBUS_Slave_Step7_2.1.pdf.
You find this document on the CD supplied with the MC100. The newest version of the document can be downloaded from
http://www.hms.se/products/products.asp?PID=321&ProductType=Anybus-CompactCom

You find the GDS files on the CD supplied with the MC100.

7 Operating the MC100

7.1 Process Data Exchange (Cyclic data)

Due to limitations in the Profibus structure the data for the MC100 and the attached pumps are multiplexed as described below.

Data are sent to and from the MC100 on a cyclic basis in a data package of 23 data word (each of 2 bytes). The MC100 acknowledge by returning a package of 23 data words.
The communications runs continuously – i.e. also if no parameters are changed.

7.1.1 Structure of the data package sent to and received from the MC100

Data sent to the MC100 (PLC → MC100):

Data word no	Content	Described in section
0	MC100 control bits	7.1.2
1	Control pump 1 and 2	7.1.4
2	Control pump 3 and 4	7.1.4
3	Control pump 5 and 6	7.1.4
4	Control pump 7 and 8	7.1.4
5	Control pump 9 and 10	7.1.4
6	Control pump 11 and 12	7.1.4
8	Control pump 13 and 14	7.1.4
9	Control pump 15 and 16	7.1.4
10	Header for word 12 to 21	7.2.2
11	Header for special use	7.2.4
12	Volume data for the pump selected in word 0 – part 1	7.2.1
13	Volume data for the pump selected in word 0 – part 2	7.2.1
14	Tube used in the pump selected in word 0	7.2.1
15	Speed data for the pump selected in word 0	7.2.1
16	Acceleration data for the pump selected in word 0	7.2.1
17	Reverse data for the pump selected in word 0	7.2.1
18	Density data for the pump selected in word 0 – part 1	7.2.1
19	Density data for the pump selected in word 0 – part 2	7.2.1
20	Calibration data for the pump selected in word 0 – part 1	7.2.1
21	Calibration data for the pump selected in word 0 – part 2	7.2.1
22	Na	

The data package will always consist of the control words for all possible pumps (word 1 to 9 – please see above) regardless of the number of pumps attached to the MC100. The control for pumps which are not present will be ignored.

The data are sent with the lowers number first i.e. from data word 0 to data word 22.

When the above data package is received by the MC100 it acknowledges by returning a new data package (MC100 → PLC). The structure of the returned data package is different if the return data are requested as a data communication or a text string. This is selected in data word 10 as described in section 7.2.2

If the PLC has requested a data communication:

Data word no	Content	Described in section
0	MC100 control bits	7.1.3
1	Control pump 1 and 2	7.1.5
2	Control pump 3 and 4	7.1.5
3	Control pump 5 and 6	7.1.5
4	Control pump 7 and 8	7.1.5
5	Control pump 9 and 10	7.1.5
6	Control pump 11 and 12	7.1.5
8	Control pump 13 and 14	7.1.5
9	Control pump 15 and 16	7.1.5
10	Header for word 12 to 21	7.2.3
11	For future use	7.2.4
12	Volume data for the pump selected in word 0 – part 1	7.2.1
13	Volume data for the pump selected in word 0 – part 2	7.2.1
14	Tube used in the pump selected in word 0	7.2.1
15	Speed data for the pump selected in word 0	7.2.1
16	Acceleration data for the pump selected in word 0	7.2.1
17	Reverse data for the pump selected in word 0	7.2.1
18	Density data for the pump selected in word 0 – part 1	7.2.1
19	Density data for the pump selected in word 0 – part 2	7.2.1
20	Calibration data for the pump selected in word 0 – part 1	7.2.1
21	Calibration data for the pump selected in word 0 – part 2	7.2.1
22	Alarm and warning	7.2.5

If the PLC has requested a text string:

Data word no	Content	Described in section
0	MC100 control bits	7.1.3
1	Control pump 1 and 2	7.1.5
2	Control pump 3 and 4	7.1.5
3	Control pump 5 and 6	7.1.5
4	Control pump 7 and 8	7.1.5
5	Control pump 9 and 10	7.1.5
6	Control pump 11 and 12	7.1.5
8	Control pump 13 and 14	7.1.5
9	Control pump 15 and 16	7.1.5
10	Header for word 12 to 21	7.2.3
11	For future use	7.2.4
12	Text byte 1 and 2	
13	Text byte 3 and 4	
14	Text byte 5 and 6	
15	Text byte 7 and 8	
16	Text byte 9 and 10	
17	Text byte 11 and 12	
18	Text byte 13 and 14	
19	Text byte 15 and 16	
20	Text byte 17 and 18	
21	Text byte 19 and 20	
22	Alarm and warning	7.2.5

7.1.2 Process control bits – word 0 (PLC → MC100)

Word 0 (2 bytes) is allocated for MC100 control bits as shown below.

Word 0

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1.7	B1.6	B1.5	B1.4	B1.3	B1.2	B1.1	B1.0	B0.7	B0.6	B0.5	B0.4	B0.3	B0.2	B0.1	B0.0

B0.0-4:	Sets the active pump number
B0.5-7	Reserved for future use
B1.0:	Mode bit 0; please see below
B1.1:	Mode bit 1; please see below
B1.2-4	Reserved for future use
B1.5	Alarm reset: will reset lowest alarm or warning number. To reset more alarms/warnings B1.5 must be reset to 0 and then raised to 1 again for each alarm/warning.
B1.6	Rescan the FlexNet for pumps. The FlexNet is scanned for pumps and a new table of the attached pumps are written in the MC100. NB. This will result in a reset of all the attached pumps.
B1.7	Total reset of MC100. NB. This will result in a reset of all the attached pumps to default values.

Modes selected by mode bit 0 and 1:

MC100 working modes:	Mode bit 0	Mode bit 1
Individual	1	0
Parallel	0	1
Serial	1	1
Na	0	0

Individual mode

When selected the attached pumps are operated individually. I.e. volumes; dispense signals; calibration values etc. has to be sent to each pump.

Parallel mode

Parallel mode requires that all pumps not disabled are of the same type, i.e. PD12 or PD22 or GD30.
In parallel mode the virtual pump 0 is used to hold common parameters for all the enabled pumps.
In parallel mode the common data are:

- Volume
- Pump speed
- Acceleration
- Tube size
- Density

If parameters are sent to a pump different from pump 0, there is

generated a warning 10 and the parameters are discarded.
Please note that in parallel mode the calibration is NOT a common data. The pumps will still have to be calibrated individually to cope with differences in the tubes, positioning of the tubes in the pump head – etc. The MC100 will take care of sending the parameters from pump 0 to all the connected enabled pumps.
If pumps of different types are not disabled in parallel/serial mode before changing to serial mode Alarm 08 is generated.

Serial mode

Serial mode requires that all pumps not disabled are of the same type, i.e. PD12 or PD22 or GD30.
In serial mode the virtual pump 0 is used to hold common parameters for all the enabled pumps.
In serial mode the common data are:

- Volume
- Pump speed
- Acceleration
- Density
- Calibration

Please note that in serial mode the tube size is NOT a common data.
When parameters are sent to the MC100 in serial mode the MC100 takes all parameters EXCEPT tube-size when sent to pump 0 and ONLY the tube size when sent to a pump number different from 0.

In serial mode the filling volume is divided to the enabled pumps based on the individual tube sizes. The MC100 do a calculation, so the distance the pumps runs are the same independent of the tube size. I.e. if the tube sizes are different in the enabled pumps the filling volumes from these pumps will also be different.
If the enabled pumps are using the same tube size the filling volume will be divided equally between the pumps. Calibrations for all the pumps are carried out by calibrating pump 0.
If pumps of different types are not disabled in parallel/serial mode before changing to serial mode Alarm 08 is generated.

Na

If operation mode 0 is selected nothing will be changed in the setup.

7.1.3 Process status bits (MC100 → PLC)

As acknowledgment of receiving word 0 the MC returns word 0 with

Word 0

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1.7	B1.6	B1.5	B1.4	B1.3	B1.2	B1.1	B1.0	B0.7	B0.6	B0.5	B0.4	B0.3	B0.2	B0.1	B0.0

B0.0-4 Active pump number
B0.5-7 Reserved for future use
B1.0 Mode status bit 0; please see above
B1.1 Mode status bit 1; please see above
B1.2-3 Reserved for future use
B1.4 Ready to receive acyclic parameter transfer
B1.5 Parameter error – is reset when new parameter is accepted.
B1.6 Ready
B1.7 Alarm

Note **B1.4** in the MC100 control bits is used as a **READY-** /**BUSY** bit for explicit parameter transfer. The data bit will go low when accepting an explicit parameter transfer and will go high again when the data is processed, thereby enabling a new transfer. This handshake mechanism **MUST** be respected otherwise data will be lost.[1]

[1] Normally only used in DeviceNet versions of the MC100

7.1.4 Process control bits for the pumps– word 1 to 9 (PLC → MC100)

For each pump address (1 to 16) one byte is dedicated for control bits. I.e. one data word holds the control bits for two pumps.
Regardless of the number of pumps attached to the MC100 all pump control words has to be sent. The data for pumps not available are ignored.

Word 8		Word 7		Word 6		Word 5		Word 4		Word 3		Word 2		Word 1	
P16	P15	P14	P13	P12	P11	P10	P9	P8	P7	P6	P5	P4	P3	P2	P1

Bit mapping in each command byte (P1 to P16):

7	6	5	4	3	2	1	0
	Direction	Disable in Par./Serial	RESET		PUMP	DISP	START

Bit 0: START — Start a single Dispense cycle, when the Pump is set in Dispense mode (Bit. 1) This bit must be cleared upon receiving the BUSY bit in the status byte for the pump, see below.
Bit 1: DISP — Sets the pump in dispense mode and thereby enables the START bit to start dispenses. If removed during dispensing the pump stops immediately.
Bit 2: PUMP[2] — Starts pump running continuously with the set speed.
Bit 3: — Reserved for future use
Bit 4: RESET — To be used with future pumps
Bit 5: — Disable pump in parallel and serial mode. If set high the pump will ignore dispense and pump bites.
Bit 6: Direction[3] — [1/0] [Backwards/Normal] pump and dispense direction.
Bit 7 — Reserved for future use

[2] The DISP bit has higher priority and must be cleared before setting the PUMP bit.
[3] Available for pumps able to handle this function (GD30).

7.1.5 Process status bits from the pumps – word 1 to 9 (MC100 → PLC)

For each pump address (1 to 16) one byte is dedicated for status bits. I.e. one data word holds the status bits for two pumps.
Regardless of the number of pumps attached to the MC100 all pump control words has to be sent. The data for pumps not available are ignored.

Word 8		Word 7		Word 6		Word 5		Word 4		Word 3		Word 2		Word 1	
P16	P15	P14	P13	P12	P11	P10	P9	P8	P7	P6	P5	P4	P3	P2	P1

Bit mapping in each status byte (P1 to P16):

7	6	5	4	3	2	1	0
ALARM	Direction	DONE	Pump	Dispense	Tube Br.	BUSY	READY

Bit 0:	READY	Pump is ready (self check is OK).
Bit 1:	BUSY	1 Indicate that the pump is active, either dispensing or pumping 0 the pump is idle
Bit 2:	Tube Br.	Tube bridge bit: 1 = tube bridge on 0 = tube bridge off. Please note that due to security reasons the pump cannot run if the tube bridge is off. This is controlled by the pump controller.
Bit 3:	Dispense	Dispense bit: 1 = dispense mode
Bit 4:	Pump	Pump bit: 1 = pump mode
Bit 5:	DONE [4]	Is set when pump goes from dispensing to idle / reset by a new START bit.
Bit 6:	Direction	Handshake for bit B5 from command byte (0=normal / 1=reverse direction.)
Bit 7:	ALARM	See Chapter 7.3.2.1.1 for further information

[4] The DONE bit can be necessary to use if there is very short filling times, where the BUSY signal is not detected because of transmission times on the fieldbus network.

7.2 Operation Parameters/Parameter specifications

The section describes parameter exchange between MC100 and PLC[5]

7.2.1 List of basic parameters

Parameter	Description	Data type	Range	Default	DW
1	Volume	Double integer	1000-999990000	10000000	12-13
2	Tube	Integer	1-10	6	14
3	Speed	Integer	30-600	100	15
4	Acceleration	Integer	1-200	10	16
5	Reverse	Integer	0-5	0	17
6	Density	Double integer	50000 – 200000	100000	18-19
7	Calibration value	Double integer	50 –200 % of Volume	- - -	20-21

Please note that to allow the MC100 to be used with PLC's without capability to use floating point data the values in parameter 1, 6 and 7 (volume, density and calibration) is converted into double integer values. The MC100 will handle the double integer as a floating point value with a fixed decimal point with 5 decimals.
As a consequence of the above the PLC program must multiply the values for volume, density and calibration by 100.000 before sending the value to the MC100.
Examples: Floating point value 123.45678 must be send to the MC100 as 12345678
Floating point value 1.2 must be send to the MC100 as 120000

The parameters above are:

Volume — The volume to be dispensed at each filling. Please note that to avoid overfilling the first dispense (before calibrating) will be approximately 80% of the requested filling.

Tube — The tube number (1 to 10) used selected from the tube table. The tube table is specific for the pump type and can be downloaded from the pump controller (please see next section). The tube table for each pump type is found in appendix 2 in this manual.

Speed — The revolutions per minute of the pump. If the product is foaming the revolutions may have to be lowered. The speed range is 30 to 600; however, the upper value is dependent on the pump type and the selected tube size. Please see the details in appendix 2.

Acceleration — A number indicating the ramp up and down when starting/stopping the dispensing. The range is 1 to 200 rpm/s. The upper value is dependent on the pump type and the selected tube size.

Reverse — A number indicating the reversing of the pump after dispensing to avoid dripping of the product between dispensing. The reverse is a number in the range 0 to 10. The physical reversing is dependent on the pump type. For a PD12 the value 10 gives ¼ reverse rotation where for a PD22 the value 10 gives a full reverse rotation.

Density — The density of the product to use when calibrating. When calibrating the

[5] These parameters can also be exchanged using DPV1 Class 2 acyclic data exchange (MSAC2), contact Watson-Marlow Flexicon for a description if necessary

	weight of the filled amount of the product is entered. If the product has a density other than 1 the MC100 has to take that into the calculation of the pump data for filling to convert to volume. The density must be in the range 0,5 to 2,0 g/cm^3. Please note the conversion to integer as described above.
Calibration value	The weight of the product in g filled (found by subtracting the weight of the vial from the total weight of the filled vial). When receiving the weight MC100 calculates new pump parameters for the actual pump and send it to the pump controller. The pump will use the new setting from the first dispensing after having received the new data. If the volume is changed the calibration is reset. To avoid overfilling the fillings after entering a new volume will be approximately 70 – 80% of the requested filling volume. Hereafter a new calibration must be made. Please note that if the calibration value is outside the limits (below 50% or above 200% of the volume) a warning is generated and the calibration value is ignored. When transmitting and receiving the value for calibration please note the conversion to integer as described above.

Please consult the manual for the actual pump type for a more detailed description of the parameters.

7.2.2 Control Data Word - data word 10 (PLC → MC100)

DW 10

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
PS	P7	P6	P5	P4	P3	P2	P1	-	-	-	N4	N3	N2	N1	N0

N4-0	DW12-21	Comments
0	Not Used	
1	Request for MC100 FBM Version	
2	Application Name	
3	Pump version	For the active pump selected in DW0
4	Alarm text strings	Text string for the pending alarm
5	Warning text strings	Text string for the pending warning
6	Reserved	
7	Reserved	
8	Reserved	
9	Reserved	
10	Tube table for active pump	Tube table consisting of 10 bytes with tube diameters. [6]

N4-0 Selects the parameters type to be received in DW 12-21 if text string is requested.

P7-1 is set if the corresponding parameter has a new value to be send to the active pump (selected in DW0)
P1: A new value for the volume is set in word 12 and 13 is ready to be retrieved by the MC100
P2: A new value for the tube size is set in word 14 is ready to be retrieved by the MC100
P3: A new value for the speed is set in word 15 is ready to be retrieved by the MC100
P4: A new value for the acceleration is set in word 16 is ready to be retrieved by the MC100
P5: A new value for reverse is set in word 17 and is ready to be retrieved by the MC100
P6: A new value for density is set in word 18 and 19 and is ready to be retrieved by the MC100
P7: A new value for calibration is set in word 20 and 21 and is ready to be retrieved by the MC100

You can send more parameters to a pump in one data package – e.g. when sending a new recipe.

PS is set to request a test string in DW12 to 21. The data is selected in N4 – N0 as described above.
Please remember to reset the flags when the data has been received by the MC100.

[6] Tube diameter is an integer value with a hidden decimal point - e.g. 16 equals 1.6 mm ID

7.2.3 Status words from parameters transfer (MC100 → PLC)

DW 10

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
PS	P7	P6	P5	P4	P3	P2	P1	-	-	-	0	0	0	0	0

P7-1 and PS are handshake for parameter bit(s) in Control DW 10.
The bits are set by the MC100 when the information is received and used.

Please also check the acknowledgements in the data words. Here the MC100 sends the values present in the pump after the data has been changed. It should correspond to the data sent.

7.2.4 Data word 11

Word 11 is reserved for special functions

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

7.2.5 Alarm and warning (MC100 → PLC)

The alarms and warnings are transmitted from the MC100 to the PLC in DW21.
The structure is:

:15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
AB7	AB6	AB5	AB4	AB3	AB2	AB1	AB0	WB7	WB6	WB5	WB4	WB3	WB2	WB1	WB0

The alarms are described in details in section 8.1.1 and the warnings in section 8.1.2.

7.3 Examples:

7.3.1 New speed to pump 1:

In the following “Control” means data from the PLC to the MC100 and “Status” means data from MC100 to the PLC.
The speed for pump 1 is set to 300 rpm.

Step 1: Set pump no. 1 in MC100 Control Word DW0 Control

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	**1**

Step 2: Set 0 in DW10 Control

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0

Step 3:
Speed value 300 rpm to pump 1 in DW15 Control

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	0	0	0	0	0	0	**1**	0	0	**1**	0	**1**	**1**	0	0

Step 4: Set P3 (Bit 10) in DW10 Control

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	**0**	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0

Step 5: Check P3 (Bit 10) in DW10 Status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	**0**	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0

Step5b: If required check the new value for the speed in DW15 Status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	0	0	0	0	0	0	**1**	0	0	**1**	0	**1**	**1**	0	0

Step 6: Clear P3 (Bit 10) in DW10 Control

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0

Step 7: Check Clear P3 (Bit 10) in DW10 Status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0

The cyclic data can be read in DW10-22 and will always have the selected(active) pump in DW10 LSB, when NOT getting strings

7.3.2 New calibration value to pump 3:

In the following “Control” means data from the PLC to the MC100 and “Status” means data from MC100 to the PLC.
A new calibration value (10,034 g) is send for pump 3.

Step 1: Set pump no. 3 in MC100 Control Word Control

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	-	-	-	-	-	-	-	-	-	-	0	0	**1**	**1**

Step 2: Set 0 in DW10 Control

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0

Step 3:
Place calibration value in DW20-21.
First the calibration value has to be converted into an integer as described earlier:
10,034 * 100.000 = 1003400
Then the value is placed in DW20 and DW21 where the LSB is DW20 bit 0 and MSB is DW21 bit 15

DW 20 Control

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	1	0	0	1	1	1	1	1	0	0	0	1	0	0	0

DW21 Control

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0-	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1

Step 4: Set P7 (Bit 14) in DW10 Control

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Step 5: Check P7 (Bit 14) in DW10 Status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Step 5b: If requested check the new calibration value for the pump

DW 20 Status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	1	0	0	1	1	1	1	1	0	0	0	1	0	0	0

DW21 Status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0-	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1

Step 6: Clear P7 (Bit 14) in DW10 control

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Step 7: Check Clear P7 (Bit 14) in DW10 Status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0

7.3.2.1.1 Reading strings:

Set the request bit for receiving text strings in DW10 (bit 15) and the required text number in DW10 bit 0 – 4.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	0	0	0	0	0	0	0	-	-	-	N4	N3	N2	N1	N0

Setting the number in DW10 and the PS bit in DW11 will read the string i DW12-25 status:

Example:
In the following “Control” means data from the PLC to the MC100 and “Status” means data from MC100 to the PLC.

Request the FMB version as text

Step 1: Set the request bit for text string (bit 15) and the text number in DW10 Control

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	0	0	0	0	0	0	0	-	-	-	0	0	0	0	**1**

Step 2: Receive the text string in DW 12 to 21 Status.
“MC100 FBM Ver. x.yy.z”

8 Alarm and warnings

8.1 Alarms handling

When MC100 is in Alarm state, the only possible action is to reset the alarm. Only applies if the alarm causes are removed, otherwise the alarm will re-appear at the next attempt.

Alarms are cleared one-by-one, starting top down – meaning lowest number first.

8.1.1 Module alarms

Alarm no.	Alarm description	Action
0	No pending alarms	
1	No pumps connected during power up	Check connections /power to pumps
2	Connection to one or more pumps lost	Check connections /power to missing pump
3	Connected pumps not equal to last time	Configuration changed – Investigation or new initialization must be done
4	Attempt to access not connected pump	
5	Reverse direction not available	Pump command Bit 5: Direction set for one direction pump
6	Unstable FlexNet: Check pumps [7]	
7	FRAM storage failure: Restart or Reset	
8	Mode change not completed: check pumps	Changing mode was not possible, check pump versions, if change was to parallel or serial mode
9	Missing or defect Anybus CompactCom Module	No Alarm string available, because module not working
10	Reserved	
11	Run length limit	Run less than 5 or more than 16777215 steps
12 -17	Reserved	
NN	FB module not Ready [8]	Internal MC100 module check, possible replacement of module.

8.1.2 Pump alarms

20	Dispense not finished	Dispensing has stopped before finishing.
21	Tube bridge off at dispense start	Dispensing or pumping cannot start
22	Tube bridge off while dispensing	Dispense not finished
23	Tube bridge off at pumping start	Trying to start pumping with tube bridge off
24	Tube bridge off while pumping	Removing tube bridge while pumping

[7] Expected to be implemented in a later version

[8] Alarm is only displayed with the 2 LED's on MFSC module – both flashes RED.

8.2 Warnings handling

All warnings are cleared automatically, when data within limits are received via FB, or with clear-bit: MC100 command B1.4

In warning 08-13 by the phrase **individual** pumps, means “real” connected pumps and pump 0 means the pseudo pump, which holds common parameters in parallel and serial mode

8.2.1 Warnings

Warning no.	Warning description	Action
0	No pending warnings	
1	Fill volume out of range	Attempt to set parameter that is outside limits. Set new parameter.
2	Tube number is not in table	
3	Speed setting is out of range	
4	Acceleration setting is out of range	
5	Reverse setting is out of range	
6	Density setting is out of range	
7	Calibration is out of range	
8	Common calibration in parallel	Calibration attempt for Pump 0. Calibrate pumps individually.
9	Individual calibration in serial	Calibration attempt for individual pump, calibrate pump 0 only
10	Attempt to set common parameters to individual pump in serial mode	Set parameters via pump 0 (fictive common pump) or clear warning.
11	Attempt to calibrate pump 0 (fictive common pump) in individual mode	Clear by calibrating physical connected pumps (1 to 15).

9 Trouble shooting

9.1 Trouble-shooting

Different kind of problems can cause machine stop, errors etc. Most trouble-shooting will be based on the information from the front plate indicators and display and the Alarm list information (see 8.1.1)

Examples:

Problem: Display is flashing AL / 01 when applying power to the module, indication that the MC100 cannot find any pumps connected.

Solution: First check if power is applied to the pump(s) and they are ON, then check cabling and connectors for faults.
To check if problem has been solved, it's necessary to turn power OFF and ON again

Problem: Display is flashing AL / 03 when applying power to the module.

Solution: First check if all the pump(s) has power applied and are indicating power ON.
If this is OK, then the MC100 has stored a different configuration and must be reconfigured using the factory default configuration.
Make a factory reset to default by following the steps below:

1. Locate the dipswitches on the right side of the cabinet, turn dipswitch 8 ON.
2. Turn power ON to the module, which now starts up with the Alarm, but shortly after starts the reset sequence and starts up again without the alarm 03.
3. Turn power OFF and turn dipswitch 8 back to OFF.
4. Turn power ON again and confirm that the alarm is still removed.

Alternative:
Use the Node address switch to do a factory reset. see section 5.1

Problem: Display is shoving "**S.2.**". As a follow up on the configuration problem above, this will be the display, when the master/scanner has a different configuration of the number of cyclic bytes.

Solution:

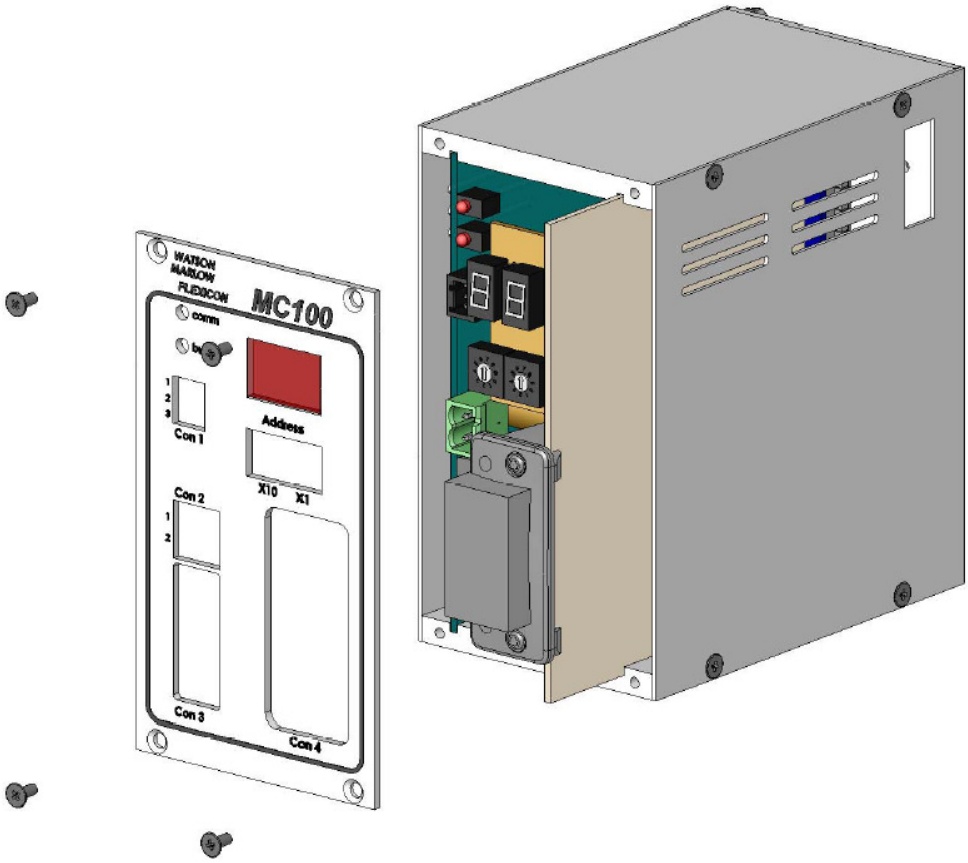
1. If this is the initial configuration, please use section **6. Configuring the fieldbus network to the MC100** and the supplied documentation and files on the CD-rom to setup the network.
2. If this situation occurs after the system has been running normally, but after a factory reset, focus must be moved to the pumps, where probably one or more pumps is not communicating on the FlexNet.
   Use the description in **6.1 Connecting the MC100 and the pumps for the first time**, to control the number of pumps that are detected on the FlexNet. When the problem is solved and the correct pumps corresponding to the correct configuration is verified, it will be necessary to do a factory reset again.

9.2 Opening the MC100 for service/replacement of PCB's

1 Power OFF for the 24V to the Module

2 Remove all cables attached the MC100.

3 To access the 2 circuit boards, remove the front cover by removing the 4 countersunk pozidrive screws and the front cover will come off. The 2 PCB's are connected with a ribboncable and has to be pulled out together for service on either one.



10 Decommissioning

10.1 Advice about dismantling / removal / disposal

Disconnect all services prior to dismantling the MC100
Disconnect all connections to other equipment.

10.2 Environmental conditions / -regulations

A MC100 is subject to the WEEE-system and may not be disposed using normal refuse collection.

The machine must be collected and disposed separately as it contains electrical components such as batteries, electrolytic capacitors and printed circuit boards. ?

Further information is available on our web-site www.flexicon.dk.

10.3 The WEEE system

WEEE stands for: ”Waste Electrical and Electronic Equipment” and the term is used commonly throughout the EU for waste from electrical and electronic equipment (EEE).

The WEEE Directive stipulates common EU regulations on treatment of WEEE. The rules are based on consideration for the environment, and they aim at limiting the amount of WEEE we have to dispose of. The objective is, on the one hand, to encourage producers to manufacture environmentally friendly products, and, on the other, to increase reuse, recycling and other forms of recovery.

The WEEE rules provide for producer responsibility, which means that producers and importers of electrical products must organise and finance take-back and treatment of WEEE, and report information to a producer register.

WEEE pictogram:

11 Appendix 1

Operating modes for MC100

(1) Individual
Individual filling means that each Pump has its own operating parameters and that fills, calibration and pumping will not be synchronized with any other connected Pump. In theory, this means that the MC12 can control up to 16 Pumps concurrently.
Calibration is carried out by first selecting the pump number via MC100 control bits as in Individual Mode and then sending the calibration value through the use of DW10 and DW20-21.

The parameters are sent to the individual Pump number after setting the pump number by the MC100 control bits.

(2) Parallel
Parallel filling is used in a multi-head filling system in which a number of bottles are changed in each cycle and filled at the same time. This gives a very high capacity. The number of Pumps and the number of bottles changed at each cycle should be identical.

If more Pumps are connected to the MC100, they can, if they are of the same type, work synchronously with the same set of parameters. In parallel mode, only parameters in Pump 0 will be used i.e. all Pumps use same volume, tube size, speed, etc.
Calibration must be carried out for the individual Pumps, by first selecting the pump number via MC100 control bits as in Individual Mode and then sending the calibration value through the use of DW20-21

(3) Serial
Serial filling is used to boost the overall capacity in a semi or fully automated system by using each Pump to fill part of the total volume.

Similar to parallel filling, Pump 0 is used for setting parameters for all connected pumps, with the exception of Function 2 for tube diameter.

For setting tube diameter, select the Pump number by the MC100 control bits as in Individual Mode and then send the tube number using DW10 and DW14. In this way, the last Pump may for instance fill a smaller part of the total volume than the other Pumps in the system. This is done by applying a smaller tube in the last Pump.

When all Pumps have been programmed, the MC100 will automatically calculate which part of the total volume the individual Pumps should fill, so that they are completed simultaneously. This gives the best capacity.

Calibration is also carried out in Pump 0, as the system perceives the whole system as one single Pump. I.e. selecting pump number 0 via MC100 control bits as in Individual Mode and then sending the calibration value through the use of DW10 and DW20-21 (see example in section.

12 Appendix 2

12.1 Tube tables

12.1.1.1 PD12

Tube Number	Inner Diameter [mm]
1	0.8
2	1.6
3	3.2
4	4.8
5	6.0
6	8.0
7	1.2
8	0.5

Tube number 1 to 6 is valid for all versions of PD12 where the tube number 7 and 8 only is valid for PD12 B (PD12 from after date???)

12.1.1.2 PD22

Tube Number	Inner Diameter [mm]
1	3.0
2	5.0
3	6.5
4	8.0
5	10.0
6	12.5

12.1.1.3 GD30

Tube Number	Inner Diameter [mm]
1	1.0 (pseudo number)

12.2 Volume, Speed and acceleration

The range for speed and acceleration is dependent on the pump type and the tube size:

12.2.1 PD12

Volume range:	0,01 to 9999,9 ml (NB remember the conversion to integer)
Speed range using tube 1, 2, 7 and 8:	30 to 600 rpm
Speed range using tube 3:	30 to 500 rpm
Speed range using tube 4 to 6:	30 to 400 rpm
Acceleration using tube 1, 2, 7 and 8:	1 to 200 rpm/s
Acceleration range using tube 3:	1 to 150 rpm/s
Acceleration using tube size 4 to 6:	1 to 100 rpm/s

12.2.2 PD22

Volume range:	10 to 9999 ml (NB remember the conversion to integer)
Speed range:	30 to 250 rpm
Acceleration range:	1 to 250 rpm/s

12.2.3 GD30

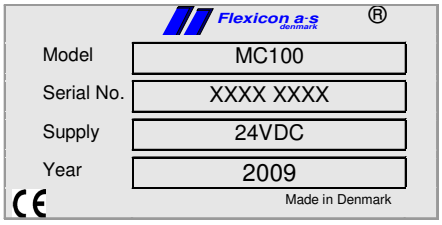
Volume range:	10 to 9999 ml (NB remember the conversion to integer)
Speed range:	30 to 750 rpm
Acceleration range:	1 to 100

13 Declaration of Conformity

We Watson-Marlow Flexicon
Frejasvej 2-6
DK-4100 Ringsted

Declare on our sole responsibility that the product:

Pump control module: **MC100**
Model: **91-120-000** / **91-121-000**



To which this declaration relates is in conformity with the following standard(s):

EN55022	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
EN61000-6-2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN61000-6-3	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments

According to the provisions in the Directives:

2004/108/EC	On the approximation of the laws of the Member States relating to electromagnetic compatibility

Signature:

September 2009

Ringsted, Denmark

Jørn Jeppesen, Development Manager