bürkert

Electromagnetic Flow Meter

PROFIBUS DP

MODULE

DATA LINK DESCRIPTION

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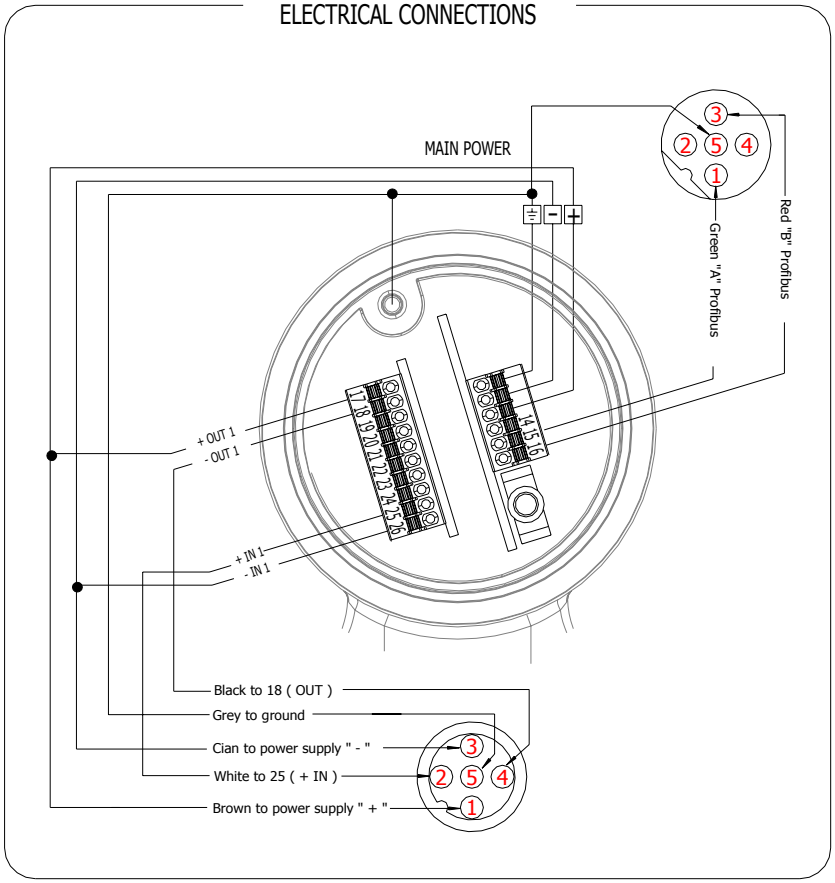
1.1 CHARACTERISTICS OF THE MODULES

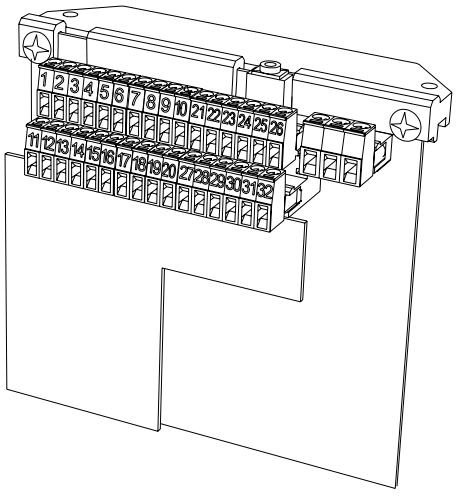
ME 35 (profibus DP for SE 56 converter)

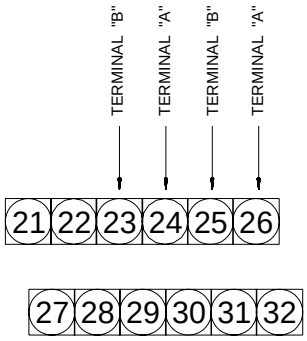


PROFIBUS
LUMBERG Model
0976 pmc 151

P.S./IN/OUT
Phoenix Model
SACC-EC-
M12FSB-5CON-
M16/0,5

ME 100 (profibus DP for SE 56 converter)





The Profibus-DP module mounted in the Electromagnetic Flow Meter is used for to connect the converter of the Flow meter to the Profibus DP fieldbus in accordance with the DIN 19245 Standard as a passive instrument (slave).

When this option is installed it is possible to read the process data from the Flow meter.
The process data consists of **Dynamic Data** and **Static Data**.
With the keyword **Dynamic Data** it is indicated measurement values which are continuously changing e.g. Flow rate, Totalizers, etc..
With the keyword **Static Data** it is indicated parameters value of the Flow meter which do not change during operation for example unit Flow rate, unit Totalizers etc. and other parameters that can be individually written to using the **Acyclic Service** or an offset to **INDEX Output** (see Fourth Configuration with 16 byte **Input/Output** or Fifth Configuration with 24 byte **Input/Output**).

The software of the slave module implement the DP standard/DPV1 functionality for the communication of the slave with a Class 1 (parameterization Master) and a Class 2 Master.
With the data exchange with the **Acyclic Service** and with the **Slot** and **Acyclic Index** it is possible to send and return configuration parameters of the Flow meter with a Class 1 or Class 2 Master.
For the communication with a Class C1 Master the **Slot** is ignored.
Only **Slot** 0 is used for the service of acyclic data exchange for the communication with a Class 2 master.

The module support four type of configurations with is possible sets the better combination of type of information of the Flow meter.
It is possible select a configuration with only 8 byte or 16 or 24 byte **Input** and insert or return **Static Data** with the **Acyclic Service** and Class 1 or Class 2 Master.
If the Master doesn't support **Acyclic Service** it is possible select the fourth configuration with 16 byte **Input/Output** or the fifth configuration with 24 byte **Input/Output.** With these last configuration and with two bytes, with the function of indexes, and the **Output** data, it is possible to insert or return **Static Data** in the Flow meter.

With the **Acyclic Service** and with the **Slot** and **Acyclic Index** it is possible to read the data stored in the Internal Data Logger of the Fow Meter.

The Profibus address of the instrument can be set with the converter keypad in the menu Comunication.
Baudrates range supported are from 9.6 kBaud up to 12 MBaud.
The slave module support the Diagnostic and Process Alarms for monitoring Flow rate with four thresholds.

NOTE: After the power supply of the Flow meter is switch on, there is an interval time of **5 seconds** during that the slave module remain in a Reset Phase necessary for the initialization of the Flow meter.
The reading of the data stored in the Internal Data Logger and the settings for the thresholds of the Flow rate Control are possible only with the **Acyclic Service** and with the **Slot** and **Acyclic Index**.

1.2. PROFIBUS IDENT NUMBER

The Profibus Identification Number is 0008hex (8dec).

1.3. SLAVE PARAMETERIZATION

The parameters specified in this respect reach the slave via the parameterization message of the parameterization Master.

The parameterization data consists of the following:

- DP standard parameters with a length of 7 bytes according to EN 50170
- DPV1 status bytes with a length of 3 bytes according to extensions of EN 50170 which immediately follow the specified DP standard parameters

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- Optional user parameterization data that immediately follow the DPV1 status bytes (not implemented for the this slave module).
Default Parameterization:

Default parameterization makes it possible for old DP standard masters to exchange data with the DPV1 slave despite missing DPV1 status bytes.
The parameterization message is 7 bytes long and in this case, the slave will use a set of default values for the missing DPV1 status bytes.

SETTINGS OF THE STATION PARAMETER:

DP Interrupt Mode	DPV0
DPV1 Interrupts:	
Update Interrupt (OB56)	No
Diagnostic Interrupt(OB82)	No
Hardware Interrupt(OB40 to OB 47)	No
General DP Parameters:	
Fail Safe	Yes
Startup when expected/actual config diff.	No
Device-Specific Parameters:	
DPV1 Mode	Enabled
Process Alarm	Disabled
Diagnostic Alarm	Disabled
Update Alarm	Disabled

Alarm Type Type mode (Slave is operated alarm type mode: only one alarm of the same type is to be active at the same time)
Hex Parameter Assignment:
DPV1_Status (0 to 2) E4,00,00

1.4. SLAVE CONFIGURATION

The Configuration possibilities are specified for the Slave module in the device description file (GSD).
Only a single Configuration is available.

The module support four type of configurations with is possible sets the better combination of types of informations of the Flow meter.

The First type of Configuration consist of 8 byte Input

With this type of configuration is possible exchange with few byte (only 8), the main data of the Flow meter.
With the setting of a **control byte**, in the configuration string of the file GSD,it is possible to set the **Data Type** of information returned by **Input** data.
The **control byte** is the third byte of the Configuration string (see below).
It is also possible to change the **Data Type** with a Class 1 and Class 2 Master and the relative **Slot** and **Acyclic Index**, during data exchange.
For details **Acyclic Service** see the relative section in this document.

The reference to the Configuration string in the GSD file is:

Module = "8 Byte Input" 0x41,0x07,0x00
1
EndModule----------
The settings in the GSD file for to use this configuration is:

SlotDefinition
Slot(1) = "Process Data" 1
EndSlotDefinition

The Configuration correspond to 8 bytes Input and the last byte indicate the **Data Type** selected .

Modifing the last byte in the GSD file it is possible to set the type of the Flow rate:

With the Configuration 0x41,0x0F,**0x00** **the Flow rate is in %** **(4 byte)**
process flags (2 byte)
dynamic variations (1 byte)
Data Type = 0 (1 byte)

Number of Input byte exchanged (8 byte)

With the Configuration 0x41,0x0F,**0x01** **the Flow rate is in tecnical unit** **(4 byte)**
process flags (2 byte)
dynamic variations (1 byte)
Data Type = 1 (1 byte)

Number of Input byte exchanged (8 byte)

With the Configuration 0x41,0x0F,**0x02** **totalizers positive** **(4 byte)**
process flags (2 byte)
dynamic variations (1 byte)
Data Type = 1 (1 byte)

Number of Input byte exchanged (8 byte)

With the Configuration 0x41,0x0F,**0x03** **partial totalizers positive** **(4 byte)**
process flags (2 byte)
dynamic variations (1 byte)
Data Type = 1 (1 byte)

Number of Input byte exchanged (8 byte)

With the Configuration 0x41,0x0F,**0x04** **totalizers negative** **(4 byte)**
process flags (2 byte)
dynamic variations (1 byte)
Data Type = 1 (1 byte)

Number of Input byte exchanged (8 byte)

With the Configuration 0x41,0x0F,**0x05** **partial totalizers negative** **(4 byte)**
process flags (2 byte)
dynamic variations (1 byte)
Data Type = 1 (1 byte)

Number of Input byte exchanged (8 byte)

The **Second** type of Configuration consist of **16 byte Input**

With this type of Configuration it is possible exchange with only 16 the same data of the precedent Configuration and in addition there are the values of the Totalizers positive or negative.
With the setting of a **control byte**, in the configuration string of the file GSD,it is possible to set the **Data Type** of information returned by **Input** data.
The **control byte** is the third byte of the Configuration string (see below).
It is also possible to change the **Data Type** with a Class 1 and Class 2 Master and the relative **Acyclic Slot** and **Acyclic Index**, during data exchange.
For details **Acyclic Service** see the relative section in this document.

The reference to the Configuration string in the GSD file is:

```
-------------------------------------------------------------
Module = "16 Byte Input" 0x41,0x0F,0x00
2
EndModule
-------------------------------------------------------------
```

The settings in the GSD file for to use this Configuration is:

```
-----------------------------------------
SlotDefinition
Slot(1) = "Process Data" 2
EndSlotDefinition
-----------------------------------------
```

The Configuration correspond to 16 bytes Input and the last byte indicate the **Data Type** selected .
Modifing the last byte in the GSD file it is possible to set the type of the Flow rate and the type of Totalizers:

With the Configuration 0x41,0x0F,**0x00 the Flow rate is in %** **(4 byte)**
totalizers positive **(4 byte)**
partial totalizers positive **(4 byte)**
process flags (2 byte)
dynamic variations (1 byte)
the Data Type = 0 (1 byte)

Number of Input byte exchanged (16 byte)

With the Configuration 0x41,0x0F,**0x01 the Flow rate is in %** **(4 byte)**
totalizers negative **(4 byte)**
partial totalizers negative **(4 byte)**
process flags (2 byte)
dynamic variations (1 byte)
the Data Type = 1 (1 byte)

Number of Input byte exchanged (16 byte)

Whit the Configuration 0x41,0x0F,**0x02 the Flow rate is in tecnical unit** **(4 byte)**
totalizers positive **(4 byte)**
partial totalizers positive **(4 byte)**
process flags (2 byte)
dynamic variations (1 byte)

the Data Type = 2	(1 byte)
Number of Input byte exchanged	(16 byte)

Whit the Configuration 0x41,0x0F,**0x03 the Flow rate is in tecnical unit (4 byte)**

totalizers negative	**(4 byte)**
partial totalizers negative	**(4 byte)**
process flags	(2 byte)
dynamic variations	(1 byte)
the Data Type = 3	(1 byte)
Number of Input byte exchanged	(16 byte)

Whit the Configuration 0x41,0x0F,**0x04 the Flow rate is in % (4 byte)**

totalizers positive	**(4 byte)**
totalizers negative	**(4 byte)**
process flags	(2 byte)
dynamic variations	(1 byte)
the Data Type = 3	(1 byte)
Number of Input byte exchanged	(16 byte)

Whit the Configuration 0x41,0x0F,**0x05 the Flow rate is in tecnical unit (4 byte)**

totalizers positive	**(4 byte)**
totalizers negative	**(4 byte)**
process flags	(2 byte)
dynamic variations	(1 byte)
the Data Type = 3	(1 byte)
Number of Input byte exchanged	(16 byte)

The third type of Configuration consist of 24 byte Input

This configuration is used when there is necessary to exchange the information about totalizers positive and negative at the same time.
The difference with the precedent configurations is the presence of the totalizers positive and negative contemporary in the block of data exchanged
With the setting of a **control byte**, in the configuration string of the file GSD,it is possible to set the **Data Type** of information returned by **Input** data.
The **control byte** is the third byte of the Configuration string (see below).
It is also possible to change the **Data Type** with a Class 1 and Class 2 Master and the relative **Acyclic Slot** and **Acyclic Index**, during data exchange.
For details **Acyclic Service** see the relative section in this document.

The reference to the Configuration string in the GSD file is:

```
-------------------------------------------------------
Module = "24 Byte Input" 0x41,0x17,0x00
3
EndModule
-------------------------------------------------------
```

The settings in the GSD file for to use this configuration is:

```
----------------------------------------
SlotDefinition
```

Slot(1) = "Process Data" 3
EndSlotDefinition

The Configuration correspond to 24 bytes Input and the last byte indicate the **Data Type** selected .

Changing the last byte in the GSD file it is possible to set the type of the Flow rate:

With the Configuration 0x41,0x0F,**0x00 the Flow rate is in %** **(4 byte)**

totalizers positive	(4 byte)
partial totalizers positive	(4 byte)
totalizers negative	(4 byte)
partial totalizers negative	(4 byte)
process flags	(2 byte)
dynamic variations	(1 byte)
the Data Type = 0	(1 byte)
Number of Input byte exchanged	(24 byte)

With the Configuration 0x41,0x0F,**0x01 the Flow rate is in technical unit** **(4 byte)**

totalizers positive	(4 byte)
partial totalizers positive	(4 byte)
totalizers negative	(4 byte)
partial totalizers negative	(4 byte)
process flags	(2 byte)
dynamic variations	(1 byte)
the Data Type = 1	(1 byte)
Number of Input byte exchanged	(24 byte)

The fourth type of configuration consist of 16 byte Input/Output

With this type of configuration is possible to insert or return data from the Flow meter with two indexes exchanged with the 16 byte **Output** data.
With the 16 byte **Output** data it is possible to insert other parameters of the Flow meter in the same way used with the **Acyclic Service** and Class 1 and Class 2 Master.

The reference to the Configuration string in the GSD file is:

Module = "16 Byte Input/Output" 0xC0,0x0F,0x0F
4
EndModule

The settings in the GSD file for to use this configuration is:

SlotDefinition
Slot(1) = "Process Data" 4
EndSlotDefinition

The Configuration correspond to 16 bytes **Input/Output.**
For details about the type of the data see the Section 2 **Cyclic Service** below in this document.

The fifth type of configuration consist of 24 byte Input/Output

With this type of configuration is possible to insert or return data from the Flow meter with two indexes

exchanged with the 24 byte **Output** data.
With the 24 byte **Output** data it is possible to insert other parameters of the Flow meter in the same way used with the **Acyclic Service** and Class 1 and Class 2 Master.

The reference to the Configuration string in the GSD file is:

```
-------------------------------------------------------------------
Module = "24 Byte Input/Output" 0xC0,0x17,0x17
5
EndModule
-------------------------------------------------------------------
```

The settings in the GSD file for to use this configuration is:

```
--------------------------------------
SlotDefinition
Slot(1) = "Process Data" 5
EndSlotDefinition
--------------------------------------
```

The Configuration correspond to 24 bytes **Input/Output.**
For details about the type of the data see the Section 2 **Cyclic Service** below in this document.

NOTE: Any other configuration will not be accepted.

1.5. SLAVE DIAGNOSTIC AND ALARMS

The module support the Diagnostic and Process Alarms for monitoring Flow rate with four thresholds.

With the **Acyclic Service** and a Class 1 or Class 2 Master and the relative **Acyclic Slot** and **Acyclic Index** it is possible insert four thresholds for monitoring the Flow rate.

The thresholds are:

Flow rate High Alarm
Flow rate High Warning
Flow rate Low Warning
Flow rate Low Alarm

The control is implemented for the Flow rate in technical unit only.

After the insertion of the four thresholds of the Flow rate in **technical unit**, with the **Acyclic Service** and the relative **Acyclic Slot** and **Acyclic Index**, it is necessary to enable the control of the Flow rate.

With the **Acyclic Service** and the relative **Acyclic Slot** and **Acyclic Index** it is possible to enable the control of the Flow rate and if the value of the Flow rate measured by the Flow meter, exceed one of the thresholds, a diagnostic message in sended to the master.

With the **Acyclic Service** and the realtive **Acyclic Slot** and **Acyclic Index** it is possible to enable the DPV1 Process Alarms for the masters that support this information.
The Process Alarms are set when the value of the Flow rate measured by the Flow meter exceed one of the two thresholds High Alarm or Low Alarm.
Diagnostic message in details:

The standard diagnostic consists of 6 bytes and in addition, the alarm mechanism with extensions is used.

Structure of the Standard Diagnostic:

byte 0: station_status_1
byte 1: station_status_2
byte 2: station_status_3
byte 3: master_adress
byte 4: pno_ident_number_high
byte 5: pno_ident_number_low

The implemented diagnostic concept supports the Device-related diagnostic (primarily status messages)

According to the diagnostic message of the DPV1 slave consists of the following:

byte 6: sing_len
byte 7: alarm_type
byte 8: slot_number
byte 9: specifier
byte 10: **alarm_data**
byte 11: 0x00

Details of the information in the byte **alarm_data**:

alarm_data = 0x00 --> Flow rate Normal
alarm_data = 0x01 --> Flow rate High Alarm
alarm_data = 0x02 --> Flow rate High Warning
alarm_data = 0x03 --> Flow rate Low Warning
alarm_data = 0x04 --> Flow rate Low Alarm

Max Flow Rate value
//
//
//////////////// alarm_data = 0x01 ////////////////
//
//
High Alarm Threshold value
//
//
//////////////// alarm_data = 0x02 ////////////////
//
//
High Warning Threshold value
//
//
//////////////// alarm_data = 0x00 ////////////////
//
//
Low Warning Threshold value
//
//
//////////////// alarm_data = 0x03 ////////////////
//
//
Low Alarm Threshold value
//

//
//////////////// alarm_data = 0x04 ////////////////
//
//
Min Flow Rate value

1.6. SETTING THE SLAVE ADDRESS

The Profibus address of the slave can be set with the converter keypad and the menu

7 - Communication --> Address

For the changing of address it's not necessary to switch off the Flow meter by removing the power supply, because the module detect when the address is changed it set the function Autoreset.
After the time of 5 seconds the slave module return in data exchange with the new address.

NOTE: For reasons of compatibility the menu Address of the Profibus is the same used for inserting the address of the RS-485 communication channel of the Flow meter that can accept values in the range 000-255, but the valid range for the Profibus Address is only 001, 002…126.

NOTE: The menu Communication is visible in the screen of the Flow meter only if the parameter RS 485 is set ON in the menu 11-Internal Data.

1.7. BAUDRATES

The Baudrates supported are:

9.6 kBaud
19.2 kBaud
31.25 kBaud
45.45 kBaud
93.75 kBaud
187.5 kBaud
500 kBaud
1.5 MBaud
3 MBaud
6 MBaud
12 MBaud

The baudrate is automatically recognized by the slave module.

1.8. GSD FILE

The name of the GSD file is ME10034.GSD is included on the shipment packaging .

1.9. TERMINALS DESIGNATION AND CABLE CONNECTION

For the connection of the Profibus cable to the Flow meter see the section 1.1 Characteristics of the module.

Cable specification:

All cables used must meet the following parameters according to the PROFIBUS specification for copper signal cable data wires.

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The connectors must allow these connections.

Parameter	**DP, Cable type A**
Surge impedance in Ω	135...165 for a frequency of 3...20 MHz
Effective capacitance (pF/m)	≤ 30
Loop resistance (Ω/km)	≤ 110
Core design (solid)	AWG 22/1
Core design (flexible)	> 0,32 mm²

The table shows the cable parameters for PROFIBUS copper signal cables with RS-485 transmission standard.

2. CYCLIC DATA EXCHANGE

With the **Cyclic Service** of data exchange the slave return **Dynamic Data** that include measurement values which are continuously changing e.g. Flow rate, totalizers, etc..

The module support five type of configurations with is possible sets the better combination of type of information of the Flow meter.
The type of Configuration is set in the file GSD.

Below there are the description of the possible types of configuration with the realtive structure of data:

2.1. FIRST CONFIGURATION: 8 BYTE INPUT

Below there is a description of the contents of each byte:

bytes 0-3:
(32 bit single precision IEEE floating point, MSB first) Flow rate in % or Flow rate in t.u. or
(32 bit long integer, MSB first) totalizer for TOTAL or PARTIAL volume + or - or batch quantity
(see section 2.2 Data Type)

bytes 4-5: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

byte 6: (8 bits integer) measurement dynamic variation as a %
byte 7: (8 bits integer) Data Type (see section 2.2 Data Type)

NOTE: The values in the "32 bits single precision IEEE floating point" format are floating point numbers which can be represented during writing by any decimal digits. To keep the same numerical format visible

on the instrument display however, it is necessary to calculate the decimal figures with a rather complex algorithm which takes account of instrument precision, flow rate measurement unit, etc. For this purpose and to avoid useless calculations, the number of decimals to use to represent the flow rate values is supplied separately. With the acyclic service it is possible to return the value (see **Acyclic Index Read = 20(dec) Static Process Data of the Flow Meter** byte position 13).

NOTE:The counters are expressed with a 32 bit integer. The «counter decimal figures» parameter, indicates the point position starting from the right: 0 = no decimal, 1=1 decimal figure, and so on. (see **Acyclic Index Read = 20(dec) Static Process Data of the Flow Meter** byte position 12)

2.2. DATA TYPE

The firsts four byte of the **Dynamic Data** Block are the information about the Flow rate or Totalizers.

With the **Control byte** of the Configuration in the GSD file (see the Section Slave Configuration) it is possible to set the type of the Flow rate returned by the slave or the type of the Totalizers.
The type of the Flow rate may be in % or in technical unit in base of the value of the **Control byte** inserted in the Configuration string.

The byte 7 indicate the current type of Flow rate selected or the type of the totalizers:

byte 7 = 0 --> Flow rate in %
byte 7 = 1 --> Flow rate in technical unit
byte 7 = 2 --> totalizers positive or batch quantity (batch quantity only for ML M3F)
byte 7 = 3 --> partial totalizers positive or batch counter (batch counter only for ML M3F)
byte 7 = 4 --> totalizers negative or batch quantity (data valid only for ML 210)
byte 7 = 5 --> partial totalizers negative or batch counter (data valid only for ML 210)

There is a second way to set the type of the Flow rate using the **Acyclic Service** during data exchange (see section **Acyclic Service**).

2.3. SECOND CONFIGURATION: 16 BYTE INPUT

Below there is a description of the contents of each byte:

bytes 0-3: (32 bit single precision IEEE floating point, MSB first) Flow rate in % or Flow rate in t.u. (see section 2.4 Data Type)
bytes 4-7: (32 bit long integer, MSB first) totalizer for TOTAL volume + or - or batch quantity (see section 2.4 Data Type)
bytes 8-11: (32 bit long integer, MSB first) totalizer for TOTAL or PARTIAL volume + or - or batch counter (see section 2.4 Data Type)
bytes 12-13: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative

bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

byte 14: (8 bits integer) measurement dynamic variation as a %
byte 15: (8 bits integer) Data Type (see section 2.4 Data Type)

NOTE: The values in the "32 bits single precision IEEE floating point" format are floating point numbers which can be represented during writing by any decimal digits. To keep the same numerical format visible on the instrument display however, it is necessary to calculate the decimal figures with a rather complex algorithm which takes account of instrument precision, flow rate measurement unit, etc. For this purpose and to avoid useless calculations, the number of decimals to use to represent the flow rate values is supplied separately. With the acyclic service it is possible to return the value (see **Acyclic Index Read = 20(dec) Static Process Data of the Flow Meter** byte position 13).

NOTE:The counters are expressed with a 32 bit integer. The «counter decimal figures» parameter, indicates the point position starting from the right: 0 = no decimal, 1=1 decimal figure, and so on. (see **Acyclic Index Read = 20(dec) Static Process Data of the Flow Meter** byte position 12)

2.4. DATA TYPE

The firsts four byte of the **Dynamic Data** Block are the information about the Flow rate.
After these bytes there are eight byte for the totalizers.

With the **Control byte** of the Configuration (see the Section Slave Configuration) it is possible to set the type of the Flow rate returned by the slave and the type of totalizers.

There are six possible combination of type of data in base of the value inserted in the **Control byte** of the Configuration string in the GSD file.

The byte 15 indicate the current type of data selected:

byte 15 = 0 --> Flow rate in %
totalizers positive or batch quantity (batch quantity only for ML M3F)
partial totalizers positive or batch counter (batch counter only for ML M3F)

byte 15 = 1 --> Flow rate in %
totalizers negative or batch quantity (data valid only for ML 210)
partial totalizers negative or batch counter (data valid only for ML 210)

byte 15 = 2 --> Flow rate in technical unit
totalizers positive or batch quantity (batch quantity only for ML M3F)
partial totalizers positive or batch counter (batch counter only for ML M3F)

byte 15 = 3 --> Flow rate in technical unit
totalizers negative or batch quantity (data valid only for ML 210)
partial totalizers negative or batch counter (data valid only for ML 210)

byte 15 = 4 --> Flow rate in %
totalizers positive or batch quantity (batch quantity only for ML M3F)
totalizers negative or batch quantity (data valid only for ML 210)

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byte 15 = 5 --> Flow rate in technical unit
totalizers positive or batch quantity (batch quantity only for ML M3F)
totalizers negative or batch quantity (data valid only for ML 210)

For details see the section Slave Configuration.

There is a second way to set the type of the Flow rate using the **Acyclic Service** during data exchange (see section **Acyclic Service**).

2.5. THIRD CONFIGURATION: 24 BYTE INPUT

Below there is a description of the contents of each byte:

bytes 0-3: (32 bit single precision IEEE floating point, MSB first) Flow rate in % or Flow rate in t.u. (see section 2.6 Flow Rate Type)
bytes 4-7: (32 bit long integer, MSB first) totalizer for TOTAL volume + or batch quantity (batch quantity only for ML M3F)
bytes 8-11: (32 bit long integer, MSB first) totalizer for PARTIAL volume + or batch counter (batch counter only for ML M3F)
bytes 12-15: (32 bit long integer, MSB first) totalizer for TOTAL volume - or batch quantity (data valid only for ML 210)
bytes 16-19: (32 bit long integer, MSB first) totalizer for PARTIAL volume - or batch counter (data valid only for ML 210)
bytes 20-21: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

byte 22: (8 bits integer) measurement dynamic variation as a %
byte 23: (8 bits integer) Data Type (see section 2.6 Data Type)

NOTE: The values in the "32 bits single precision IEEE floating point" format are floating point numbers which can be represented during writing by any decimal digits. To keep the same numerical format visible on the instrument display however, it is necessary to calculate the decimal figures with a rather complex algorithm which takes account of instrument precision, flow rate measurement unit, etc. For this purpose and to avoid useless calculations, the number of decimals to use to represent the flow rate values is supplied separately. With the acyclic service it is possible to return the value (see **Acyclic Index Read = 20(dec) Static Process Data of the Flow Meter** byte position 13).

NOTE:The counters are expressed with a 32 bit integer. The «counter decimal figures» parameter, indicates the point position starting from the right: 0 = no decimal, 1=1 decimal figure, and so on. (see **Acyclic Index Read = 20(dec) Static Process Data of the Flow Meter** byte position 12)

2.6. DATA TYPE

The firsts four byte of the **Dynamic Data** Block are the information about the Flow rate.
With the **Control byte** of the Configuration in the GSD file (see the Section Slave Configuration) it is possible to set the type of the Flow rate returned by the slave.
The type of the Flow rate may be in % or in technical unit in base of the value of the **Control byte** inserted in the Configuration string.

The byte 23 indicate the current type of data selected:

byte 23 = 0 --> Flow rate in %
byte 23 = 1 --> Flow rate in technical unit

For details see the Section Slave Configuration.

There is a second way to set the type of the Flow rate using the **Acyclic Service** during data exchange (see section **Acyclic Service**).

2.7. FOURTH CONFIGURATION: 16 BYTE INPUT/OUTPUT

With the precedent configurations, the type of data as **Static Data** and other parameters of the Flow meter, the only possible way for to return the data was with **Acyclic Service** and Class 1 or Class 2 Master.
In the same way the insertion of data in the slave was with **Acyclic Service**.

If the Master don't support the **Acyclic Service**, with this configuration it is possible, with two indexes, read and write **Static Data** and insert data to the slave as Output data.
With the **Output** data it is possible the insertion of the values of the two Indexes used for the selection of the type of data returned with the Input data, for example the **Static Data** or others parameters, and insert other data as the Time of the clock of the Flow meter and other parameters.

The two indexes used for the selection and the insertion of the data are:
INDEX Input
INDEX Output

The two indexes are inserted with the Output data during the cyclic data exchange in the firsts two byte of the 16 Output data (see the structure of the 16 bytes below in this section).

The current value of the two index are returned with the first two byte of the 16 bytes Input data (see the structure of the 16 bytes below in this section).

The byte INDEX Input in the 16 bytes of the Output data, is used for the selection of the type of data returned with the 16 Input data.
With the value inserted in this byte it is possible to select the type of the **Dynamic Data** retuned or the type of the **Static Data** or other internal parameter of the Flow meter or of the Slave as for example the Profibus address etc.

The byte INDEX Output in the 16 bytes of the Output data, is used for indicate the type of information that are inserted with the successive bytes that follow the two indexes (byte 2 --> 15) in the 16 Output data.
For example with the value inserted in this byte it is possible to indicate that the bytes that follow the firsts

two bytes (the two indexes) are the bytes for to update the clock (to update the clock is possible only for ML 210) of the Flow meter.

The firsts two byte of the Input data indicate always the current value of the INDEX Input and Output inserted with the 16 Output data.

NOTE: The values in the "32 bits single precision IEEE floating point" format are floating point numbers which can be represented during writing by any decimal digits. To keep the same numerical format visible on the instrument display however, it is necessary to calculate the decimal figures with a rather complex algorithm which takes account of instrument precision, flow rate measurement unit, etc. For this purpose and to avoid useless calculations, the number of decimals to use to represent the flow rate values is supplied separately (see **INDEX Input = 30(dec) Static Process Data of the Flow Meter** byte position 15).

NOTE: The counters are expressed with a 32 bit integer. The «counter decimal figures» parameter, indicates the point position starting from the right: 0 = no decimal, 1=1 decimal figure, and so on (see **INDEX Input = 30(dec) Static Process Data of the Flow Meter** byte position 15).

Below there is a description of the contents of each 16 bytes for every type of **INDEX Input** (this index is inserted with the first byte of the Output data):

INDEX Input = 0(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) **Flow rate in %**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume + or batch quantity (batch quantity only for ML M3F)
bytes 10-13: (32 bit long integer, MSB first) totalizer for PARTIAL volume + or batch counter (batch counter only for ML M3F)
bytes 14-15: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

INDEX Input = 1(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) **Flow rate in %**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume - or batch quantity (data valid only for ML 210)

bytes 10-13: (32 bit long integer, MSB first) totalizer for PARTIAL volume - or batch counter (data valid only for ML 210)
bytes 14-15: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

INDEX Input = 10(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first)) **Flow rate in t.u.**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume + or batch quantity (batch quantity only for ML M3F)
bytes 10-13: (32 bit long integer, MSB first) totalizer for PARTIAL volume + or batch counter (batch counter only for ML M3F)
bytes 14-15: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

INDEX Input = 11(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) **Flow rate in t.u.**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume - or batch quantity (data valid only

for ML 210)
bytes 10-13: (32 bit long integer, MSB first) totalizer for PARTIAL volume - or batch counter (data valid only for ML 210)
bytes 14-15: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

INDEX Input = 20(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) **Flow rate in %**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume + or batch quantity (batch quantity only for ML M3F)
bytes 10-13: (32 bit long integer, MSB first) totalizer for TOTAL volume - or batch quantity (data valid only for ML 210)
bytes 14-15: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

INDEX Input = 21(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) **Flow rate in t.u.**

bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume + or batch quantity (batch quantity only for ML M3F)
bytes 10-13: (32 bit long integer, MSB first) totalizer for TOTAL volume - or batch quantity (data valid only for ML 210)
bytes 14-15: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

INDEX Input = 30(dec) Static Process Data of the Flow Meter

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) Flow rate scale range in t.u.
bytes 6-10: (5 bytes ASCII) flow rate measurement unit
byte 12: (8 bits integer) number of decimals after the point for flow rate display

INDEX Input = 31(dec) Static Process Data of the Flow Meter

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-4: (3 bytes ASCII) measurement unit of the counters
byte 6: (8 bits integer) number of decimals after the point for totalizers display
byte 8: (8 bits integer) measurement samples per second (Hz)

byte 20=10(dec) measurement frequency = 10 Hz
byte 20=20(dec) measurement frequency = 20 Hz
byte 20=50(dec) measurement frequency = 50 Hz
byte 20=80(dec) measurement frequency = 80 Hz
byte 20=150(dec) measurement frequency = 150 Hz
byte 20=44(dec) measurement frequency = 300 Hz
byte 20=144(dec) measurement frequency = 400 Hz

INDEX Input = 32(dec) Slave Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
byte 2: (8 bits integer) slave address
byte 3: (8 bits integer) pno identification number high
byte 4: (8 bits integer) pno identification number low
byte 5: (8 bits integer) DPC31 ASIC Step

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bit 0 =1 if DPC31 B

byte 6: (8 bits integer) MAC State Offline / Passive Idle

bit 0 =1 if the MAC is in Passive Idle

byte 7: (8 bits integer) watchdog state

bit 0-1 = 00 --> Baud Search
01 --> Baud Control
10 --> DP_Control

byte 8: (8 bits integer) baud rate

bit 0-3 = 0000 --> 12 MBd
0001 --> 6 MBd
0010 --> 3 MBd
0011 --> 1.5 MBd
0100 --> 500 kBd
0101 --> 187.5 kBd
0110 --> 93.75 kBd
0111 --> 45.45 kBd
1000 --> 19.2 kBd
1001 --> 9.6 kBd

byte 9: (8 bits integer) DP state machine

bit 0-1 = 11 --> Data_Exchange

INDEX Input = 33(dec) Internal Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
byte 2: (8 bits integer) slave software version (major number)
byte 3: (8 bits integer) slave software version (minor number)
byte 4-9: (8 bits integer) device name («ML 210», «ML M3F»)
byte 10: (8 bits integer) Flow meter software version (major number)
byte 11: (8 bits integer) Flow meter software version (minor number)
byte 12-13: (8 bits integer) (16 bits unsigned integer, byte 13=MSB):hardware / software enabling flags, bit 0 = LSB, bit 15 = MSB:

Bits	Funzioni ML 210/M3F
0-2	current access level (0..7)
3	channel 1 impulses in use
4	channel 2 impulses in use
5	channel 1 frequency in use
6	channel 2 frequency in use
7	scale range 2 in use

8	specific weight in use
9	additional output 3 present
10	additional output 4 present
11	output 4..20 mA 2 present
12	RS232 present
13	batching functions active
14	output 4..20 mA 2 present
15	RS485 present

byte 14: (8 bits integer) current language set in the Flow meter

Format of the returned data:

0(dec) = English
1(dec) = Italian
2(dec) = French
3(dec) = Spanish

NOTE: For reading the type of language it is first necessary to send to the slave the relative command, see the **INDEX Output = 10** (below in this section) and then read the type of language in the byte 4.

INDEX Input = 34(dec) Data and Time of the Flow meter (only for ML 210)

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5 (32 bit long integer, MSB first) clock expressed in minutes starting from 01-01-1992

NOTE: The date and time are expressed with a 32 bit integer containing the number of minutes elapsed since 01-01-1992. To calculate the date starting from this number, see the programming examples in the section 4.0 PROGRAMMING ALGORITMS of this manual.

INDEX Input = 40(dec) Batch Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-3: (2 bytes 16 bit unsigned integer, MSB first) number of batch processes done for this batch memory.
bytes 4-5: (2 bytes 16 bit unsigned integer, MSB first) value of the batch safety timer expressed in tenths of seconds.
bytes 6-9: (4 bytes 32 bits unsigned long integer, MSB first) batch quantity value expressed in the same units and with the same decimal digits of the volume counters
byte 10: (8 bits integer) batch status:

Format of the returned data: 1 byte containing the batch process state:
0(dec) = batch process is correctly terminated (pre-set quantity reached).
1(dec) = batch process is running (the valve is opened and the counters are running).
2(dec) = batch process is suspended (the valve is closed before the pre-set quantity is reached).

NOTE: The recipe utilized for this configuration is the 00 in the meter and the name utilized for this recipe is PROFIBUS.

INDEX Input = 42(dec) Batch Parameters

byte 0: (8 bits integer) current INDEX Input

byte 1: (8 bits integer) current INDEX Output
byte 2: (8 bits integer) batch status:

Format of the returned data: 1 byte containing the batch process state:
0(dec) = batch process is correctly terminated (pre-set quantity reached).
1(dec) = batch process is running (the valve is opened and the counters are running).
2(dec) = batch process is suspended (the valve is closed before the pre-set quantity is reached).

byte 3: (8 bits integer) menu Measure – Cut-off es. 1(dec) / 10 = 0.1%, 255(dec) / 10 → 25.5%
byte 4: (8 bits integer) menu Batch - N.samples
byte 5: (8 bits integer) menu Batch – Diff.thr
bytes 6-7: (2 bytes 16 bit unsigned integer, MSB first) menu Batch – V.com (value expressed in the same units and with the same decimal digits of the volume counters)
bytes 8-9: (2 bytes 16 bit unsigned integer, MSB first) menu Batch – V.pre (value expressed in the same units and with the same decimal digits of the volume counters)

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Below there is a description of the contents of each 16 bytes for every type of **INDEX Output** (this index is inserted with the second byte of the Output data):

NOTE: Setting the commands only in the state OPERATE. In the state CLEAR the commands are not accepted.

INDEX Output = 10(dec) Flow Meter Commands

byte 0: (8 bits integer) INDEX Input: the value set the type of the Input data
byte 1: (8 bits integer) INDEX Output = 10(dec)
byte 2: (8 bits integer) command type

Type of command that is possible to insert in the byte 2:

Byte 2 = **0x06(hex)** command for reset the Totalizers of the Flow Meter (see the Flow Meter Manual and the relative menu for to enable which totalizers to reset by this command).

Byte 2 = **0x07(hex)** command for read the current Language used in the Flow Meter:
The information is returned by the byte 4 of the Input data with Index Input 32.

Byte 2 = **0x08(hex)** command for Reset the slave module. After 5 seconds the module return in the data exchange.

Byte 2 = **0x32(hex)** command for Autozero Calibration

Byte 2 = **0x60(hex)** command for set the type of language in the meter (Note: It is firstly necessary to read the type of the language of the meter, for to set it with this command)

Byte 3 = type of language:

0x00 = 0(dec) = English
0x01 = 1(dec) = Italian
0x02 = 2(dec) = French
0x03 = 3(dec) = Spanish

es.

Reset Totalizers

byte 0: 0xXX = index input
byte 1: 0x0A = **10(dec)** index output

byte 2: 0x06 → Command

---

es.

Reading current type language of the Flow Meter

byte 0: 0x21 = **33(dec)** index input → see **INDEX Input = 33(dec)**
byte 1: 0x0A = **10(dec)** index output

byte 2: 0x07 → Command

---

es.

Writing the type language in the Flow Meter after the firsly reading of the current language set in the meter

byte 0: 0x21 = **33(dec)** index input → see **INDEX Input = 33(dec)**
byte 1: 0x0A = **10(dec)** index output

byte 2: 0x60 = **96(dec)** Command for set language

byte 3: 0x01 → set italian language in the meter

---

es.

Set Autozero Calibration

byte 0: 0xXX = index input

byte 1: 0x0A = **10(dec)** index output

byte 2: 0x32 → Command

INDEX Output = 20(dec) Setting Data and Time in the Flow Meter (only for ML 210)

byte 0: (8 bits integer) INDEX Input: the value set the type of the Input data
byte 1: (8 bits integer) INDEX Output = 20(dec)
byte 2-5: 32 bits long integer containing the date and time expressed in minutes starting from 01-01-1992 the most significant byte must be sent first.

INDEX Output = 40(dec) Batch Commands

For to use the batch function it is firstly necessary to set ON the menu Batch in the Flow Meter (see the Flow Meter Manual)

byte 0: (8 bits integer) INDEX Input: the value set the type of the Input data
byte 1: (8 bits integer) INDEX Output = 40(dec)
byte 2: (8 bits integer) batch **Command**

0x10(hex) Read the batch data memory, the data are returned with the **INDEX Input = 40(dec)**

byte 3: (8 bits integer) batch **Code**

Type of code that is possible to insert in the byte 3:
0x40(hex) = command for reading the recipe

0x12(hex) Set batch with the code in the byte 3

byte 3: (8 bits integer) batch **Code**

Type of command that is possible to insert in the byte 3:
0x01(hex) = command for reading the current batch status (see **INDEX Input = 40(dec) or 42(dec)** for to read the status)
0x02(hex) = command for starting the current batch process
0x03(hex) = command for suspending the current batch process
0x04(hex) = command for resetting the current batch process

0x13(hex) Read the batch parameters, the data are returned with the **INDEX Input = 42(dec)**

es. Reading Batch Data:

byte 0: 0x28 = **40(dec)** index input → see **INDEX Input = 40(dec) Batch Data**
byte 1: 0x28 = **40(dec)** index output

byte 2: 0x10 → Command
byte 3: 0x40 → Code

---

es. Reading Batch Parameters:

byte 0: 0x2A = **42(dec)** index input → see **INDEX Input = 40(dec) Batch Data**

byte 1: 0x28 = **40(dec)** index output

byte 2: 0x13 → Command

---

es. Batch Commands:

byte 0: 0x28 = **40(dec)** index input → see **INDEX Input = 40(dec) Batch Data**
byte 1: 0x28 = **40(dec)** index output

byte 2: 0x12 → Command
byte 3:0x01 → Code Read Status
0x02 → Code Start Batch
0x03 → Code Stop Batch
0x04 → Code Reset the current Batch process

INDEX Output = 41(dec) Setting Batch Data Memory

With this index it is possible to insert the batch data memory

byte 0: (8 bits integer) INDEX Input: the value set the type of the Input data
byte 1: (8 bits integer) INDEX Output = 40(dec)
bytes 2-3: (2 bytes 16 bit unsigned integer, MSB first) number of batch processes done for this batch memory.
bytes 4-5: (2 bytes 16 bit unsigned integer, MSB first) value of the safety batch timer expressed in tenths of seconds.
bytes 6-9: (4 bytes 32 bits unsigned long integer, MSB first) batch quantity value expressed in the same units and with the same decimal digits of the volume counters.

NOTE: The recipe utilized for this configuration (16 bytes I/O) is the 00 in the meter and the name utilized for this recipe is PROFIBUS.
es.

Insertion of the Batch Data (insertion of the data in the meter is in real time for this type of data):

byte 0: 0x28 = **40(dec)** index input → see **INDEX Input = 40(dec) Batch Data**
byte 1: 0x29 = **41(dec)** index output

byte 2: 0x00
byte 3: 0x00 → 0(dec) value for reset the counter

byte 4: 0x00
byte 5: 0x0F → 15 (dec) safety batch timer

byte 6: 0x00
byte 7: 0x00
byte 8: 0x00
byte 9: 0x01 → 1(dec) batch quantity

INDEX Output = 42(dec) Setting Batch Parameters

With this index it is possible to insert the batch parameters

byte 0: (8 bits integer) INDEX Input: the value set the type of the Input data
byte 1: (8 bits integer) INDEX Output = 42(dec)
byte 2: (8 bits integer) menu Measure – cut-off es. 1(dec) / 10 = 0.1%, 255(dec) / 10 → 25.5%
byte 3: (8 bits integer) menu Batch - N.samples
byte 4: (8 bits integer) menu Batch – Diff.thr
bytes 6-7: (2 bytes 16 bit unsigned integer, MSB first) menu Batch – V.com (value expressed in the same units and with the same decimal digits of the volume counters)
bytes 8-9: (2 bytes 16 bit unsigned integer, MSB first) menu Batch – V.pre (value expressed in the same units and with the same decimal digits of the volume counters)

es.

Insertion of the parameters value:

byte 0: 0xXX index input
byte 1: 0x2A = **42(dec)** index output

byte 2: 0x01 → cut-off (menu Measure) = 0.1%

byte 3: 0x02 → N.samples (menu Batch) = 2

byte 4: 0x03 → Diff.thr (menu Batch) = 3%

byte 5: 0x00 → byte alignment

byte 6: 0x00
byte 7: 0x04 → V.com (menu Batch) = 00.004

byte 8: 0x00
byte 9: 0x05 → V.pre (menu Batch) = 00.005

2.8. FIFTH CONFIGURATION: 24 BYTE INPUT/OUTPUT

With the precedent configurations, the type of data as **Static Data** and other parameters of the Flow meter, the only possible way for to return the data was with **Acyclic Service** and Class 1 or Class 2 Master.
In the same way the insertion of data in the slave was with **Acyclic Service**.

If the Master don't support the **Acyclic Service**, with this configuration it is possible, with two indexes, read and write **Static Data** and insert data to the slave as Output data.
With the **Output** data it is possible the insertion of the values of the two Indexes used for the selection of the type of data returned with the Input data, for example the **Static Data** or others parameters, and insert other data as the Time of the clock of the Flow meter and other parameters.

The two indexes used for the selection and the insertion of the data are:

INDEX Input
INDEX Output

The two indexes are inserted with the Output data during the cyclic data exchange in the firsts two byte of the 24 Output data (see the structure of the 24 bytes below in this section).

The current value of the two index are returned with the first two byte of the 24 bytes Input data (see the structure of the 24 bytes below in this section).

The byte INDEX Input in the 24 bytes of the Output data, is used for the selection of the type of data returned with the 24 Input data.
With the value inserted in this byte it is possible to select the type of the **Dynamic Data** retuned or the type of the **Static Data** or other internal parameter of the Flow meter or of the Slave as for example the Profibus address etc.
The byte INDEX Output in the 24 bytes of the Output data, is used for indicate the type of information that are inserted with the successive bytes that follow the two indexes (byte 2 --> 23) in the 24 Output data.
For example with the value inserted in this byte it is possible to indicate that the bytes that follow the firsts two bytes (the two indexes) are the bytes for to update the clock (to update the clock is possible only for ML 210) of the Flow meter.

The firsts two byte of the Input data indicate always the current value of the INDEX Input and Output inserted with the 24 Output data.

NOTE: The values in the "32 bits single precision IEEE floating point" format are floating point numbers which can be represented during writing by any decimal digits. To keep the same numerical format visible on the instrument display however, it is necessary to calculate the decimal figures with a rather complex algorithm which takes account of instrument precision, flow rate measurement unit, etc. For this purpose and to avoid useless calculations, the number of decimals to use to represent the flow rate values is supplied separately (see **INDEX Input = 30(dec) Static Process Data of the Flow Meter** byte position 15).

NOTE: The counters are expressed with a 32 bit integer. The «counter decimal figures» parameter, indicates the point position starting from the right: 0 = no decimal, 1=1 decimal figure, and so on (see **INDEX Input = 30(dec) Static Process Data of the Flow Meter** byte position 15).

Below there is a description of the contents of each 24 bytes for every type of **INDEX Input** (this index is inserted with the first byte of the Output data):

INDEX Input = 0(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) **Flow rate in %**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume + or batch quantity (batch quantity only for ML M3F)
bytes 10-13: (32 bit long integer, MSB first) totalizer for PARTIAL volume + or batch counter (batch counter only for ML M3F)
bytes 14-17: (32 bit long integer, MSB first) totalizer for TOTAL volume - or batch quantity (data valid only for ML 210)
bytes 18-21: (32 bit long integer, MSB first) totalizer for PARTIAL volume - or batch quantity (data valid only for ML 210)
bytes 22-23: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold

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bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

INDEX Input = 1(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) **Flow rate in %**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume + or batch quantity (batch quantity only for ML M3F)
bytes 10-13: (32 bit long integer, MSB first) totalizer for PARTIAL volume + or batch counter (batch counter only for ML M3F)
bytes 14-15: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

byte 16: (8 bits integer) measurement dynamic variation as a %

INDEX Input = 2(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) **Flow rate in %**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume - or batch quantity (data valid only for ML 210)
bytes 10-13: (32 bit long integer, MSB first) totalizer for PARTIAL volume - or batch counter (data valid only for ML 210)
bytes 14-15: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected

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bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress
byte 16: (8 bits integer) measurement dynamic variation as a %

INDEX Input = 10(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first)) **Flow rate in t.u.**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume + or batch quantity (batch quantity only for ML M3F)
bytes 10-13: (32 bit long integer, MSB first) totalizer for PARTIAL volume + or batch counter (batch counter only for ML M3F)
bytes 14-17: (32 bit long integer, MSB first) totalizer for TOTAL volume - or batch quantity (data valid only for ML 210)
bytes 18-21: (32 bit long integer, MSB first) totalizer for PARTIAL volume - or batch counter (data valid only for ML 210)
bytes 22-23: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

INDEX Input = 11(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) **Flow rate in t.u.**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume + or batch quantity (batch quantity only for ML M3F)
bytes 10-13: (32 bit long integer, MSB first) totalizer for PARTIAL volume + or batch counter (batch counter only for ML M3F)
bytes 14-15: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active

bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

byte 16: (8 bits integer) measurement dynamic variation as a %

INDEX Input = 12(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) **Flow rate in t.u.**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume - or batch quantity (data valid only for ML 210)
bytes 10-13: (32 bit long integer, MSB first) totalizer for PARTIAL volume - or batch counter (data valid only for ML 210)
bytes 14-15: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

byte 16: (8 bits integer) measurement dynamic variation as a %

INDEX Input = 13(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) **Flow rate in %**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume + or batch quantity (batch quantity only for ML M3F)

bytes 10-13: (32 bit long integer, MSB first) totalizer for TOTAL volume - or batch quantity (data valid only for ML 210)
bytes 14-15: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

byte 16: (8 bits integer) measurement dynamic variation as a %

INDEX Input = 14(dec) Dynamic Process Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) **Flow rate in t.u.**
bytes 6-9: (32 bit long integer, MSB first) totalizer for TOTAL volume + or batch quantity (batch quantity only for ML M3F)
bytes 10-13: (32 bit long integer, MSB first) totalizer for TOTAL volume - or batch quantity (data valid only for ML 210)
bytes 14-15: (16 bit unsigned integer, MSB first) process flags:

bit 0 =1 if the excitation is too fast for the sensor connected
bit 1 =1 if the maximum alarm is active
bit 2 =1 if the minimum alarm is active
bit 3 =1 if the Flow rate exceeds the scale range value (overflow)
bit 4 =1 if one or more output impulses are saturated (too many impulses to emit)
bit 5 =1 if the measurement signal is highly disturbed or if the sensor is disconnected
bit 6 =1 if the measurement tube is empty
bit 7 =1 if the circuit powering the coils is not working or the sensor is disconnected
bit 8 =1 if the second measurement scale is active
bit 9 =1 if the Flow rate is lower than the cut-off threshold
bit10=1 if the Flow rate is negative
bit11=1 if a new measurement value calculated for the display is available
bit12=1 if the counter block signal is active
bit13=1 if dosing is in progress
bit14=1 if a calibration cycle is in progress
bit15=1 if a Flow rate simulation is in progress

byte 16: (8 bits integer) measurement dynamic variation as a %

INDEX Input = 30(dec) Static Process Data of the Flow Meter

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-5: (32 bit single precision IEEE floating point, MSB first) Flow rate scale range in t.u.
bytes 6-10: (5 bytes ASCII) flow rate measurement unit
bytes 12-14: (3 bytes ASCII) measurement unit of the counters
byte 16: (8 bits integer) number of decimals after the point for totalizers display
byte 17: (8 bits integer) number of decimals after the point for flow rate display
bytes 18-21: (32 bit long integer, MSB first) clock expressed in minutes starting from 01-01-1992 (only for ML 210)
byte 22: (8 bits integer) measurement samples per second (Hz)

byte 20=10(dec) measurement frequency = 10 Hz
byte 20=20(dec) measurement frequency = 20 Hz
byte 20=50(dec) measurement frequency = 50 Hz
byte 20=80(dec) measurement frequency = 80 Hz
byte 20=150(dec) measurement frequency = 150 Hz
byte 20=44(dec) measurement frequency = 300 Hz
byte 20=144(dec) measurement frequency = 400 Hz

NOTE: The date and time are expressed with a 32 bit integer containing the number of minutes elapsed since 01-01-1992. To calculate the date starting from this number, see the programming examples in the section 4.0 PROGRAMMING ALGORITMS of this manual.

INDEX Input = 31(dec) Slave Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
byte 2: (8 bits integer) slave address
byte 3: (8 bits integer) pno identification number high
byte 4: (8 bits integer) pno identification number low
byte 5: (8 bits integer) DPC31 ASIC Step

bit 0 =1 if DPC31 B

byte 6: (8 bits integer) MAC State Offline / Passive Idle

bit 0 =1 if the MAC is in Passive Idle

byte 7: (8 bits integer) watchdog state

bit 0-1 = 00 --> Baud Search
01 --> Baud Control
10 --> DP_Control

byte 8: (8 bits integer) baud rate

bit 0-3 = 0000 --> 12 MBd
0001 --> 6 MBd
0010 --> 3 MBd
0011 --> 1.5 MBd
0100 --> 500 kBd
0101 --> 187.5 kBd

0110 --> 93.75 kBd

0111 --> 45.45 kBd

1000 --> 19.2 kBd

1001 --> 9.6 kBd

byte 9: (8 bits integer) DP state machine

bit 0-1 = 11 --> Data_Exchange

INDEX Input = 32(dec) Internal Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
byte 2: (8 bits integer) slave software version (major number)
byte 3: (8 bits integer) slave software version (minor number)
byte 4-9: (8 bits integer) device name («ML 210», «ML M3F»)
byte 10: (8 bits integer) Flow meter software version (major number)
byte 11: (8 bits integer) Flow meter software version (minor number)
byte 12-13: (8 bits integer) (16 bits unsigned integer, byte 13=MSB):hardware / software enabling flags, bit 0 = LSB, bit 15 = MSB:

Bits	Funzioni ML 210/M3F
0-2	current access level (0..7)
3	channel 1 impulses in use
4	channel 2 impulses in use
5	channel 1 frequency in use
6	channel 2 frequency in use
7	scale range 2 in use
8	specific weight in use
9	additional output 3 present
10	additional output 4 present
11	output 4..20 mA 2 present
12	RS232 present
13	batching functions active
14	output 4..20 mA 2 present
15	RS485 present

byte 14: (8 bits integer) current language set in the Flow meter

Format of the returned data:

0(dec) = English
1(dec) = Italian
2(dec) = French
3(dec) = Spanish

NOTE: For reading the type of language it is first necessary to send to the slave the relative command, see the **INDEX Output = 10** (below in this section) and then read the type of language in the byte 4.

INDEX Input = 40(dec) Batch Data

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
bytes 2-9: (8 bytes ASCII) memory batch name (allowed characters: 0..9, a..z, A..Z, space (32 DEC, 20 HEX))
bytes 10-11: (2 bytes 16 bit unsigned integer, MSB first) number of batch processes done for this batch memory.
bytes 12-13: (2 bytes 16 bit unsigned integer, MSB first) value of the batch safety timer expressed in tenths of seconds.
bytes 14-17: (4 bytes 32 bits unsigned long integer, MSB first) batch quantity value expressed in the same units and with the same decimal digits of the volume counters
byte 18: (8 bits integer) batch status:

Format of the returned data: 1 byte containing the batch process state:
0(dec) = batch process is correctly terminated (pre-set quantity reached).
1(dec) = batch process is running (the valve is opened and the counters are running).
2(dec) = batch process is suspended (the valve is closed before the pre-set quantity is reached).

INDEX Input = 42(dec) Batch Parameters

byte 0: (8 bits integer) current INDEX Input
byte 1: (8 bits integer) current INDEX Output
byte 2: (8 bits integer) batch status:

Format of the returned data: 1 byte containing the batch process state:
0(dec) = batch process is correctly terminated (pre-set quantity reached).
1(dec) = batch process is running (the valve is opened and the counters are running).
2(dec) = batch process is suspended (the valve is closed before the pre-set quantity is reached).

byte 4: (8 bits integer) menu Measure – cut-off es. 1(dec) / 10 = 0.1%, 255(dec) / 10 → 25.5%
byte 5: (8 bits integer) menu Batch - N.samples
byte 6: (8 bits integer) menu Batch – Diff.thr
bytes 8-9: (2 bytes 16 bit unsigned integer, MSB first) menu Batch – V.com (value expressed in the same units and with the same decimal digits of the volume counters)
bytes 10-11: (2 bytes 16 bit unsigned integer, MSB first) menu Batch – V.pre (value expressed in the same units and with the same decimal digits of the volume counters)

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Below there is a description of the contents of each 24 bytes for every type of **INDEX Output** (this index is inserted with the second byte of the Output data):

NOTE: Setting the commands only in the state OPERATE. In the state CLEAR the commands are not accepted.

INDEX Output = 10(dec) Flow Meter Commands

byte 0: (8 bits integer) INDEX Input: the value set the type of the Input data
byte 1: (8 bits integer) INDEX Output = 10(dec)
byte 2: (8 bits integer) command type

Type of command that is possible to insert in the byte 2:

Byte 2 = **0x06(hex)** command for reset the Totalizers of the Flow Meter (see the Flow Meter Manual and the relative menu for to enable which totalizers to reset by this command).

Byte 2 = **0x07(hex)** command for read the current Language used in the Flow Meter:
The information is returned by the byte 4 of the Input data with Index Input 32.

Byte 2 = **0x08(hex)** command for Reset the slave module. After 5 seconds the module return in the data exchange.

Byte 2 = **0x32(hex)** command for Autozero Calibration

Byte 2 = **0x60(hex)** command for set the type of language in the meter (Note: It is firstly necessary to read the type of the language of the meter, for to set it with this command)

Byte 3 = type of language:

0x00 = 0(dec) = English
0x01 = 1(dec) = Italian
0x02 = 2(dec) = French
0x03 = 3(dec) = Spanish

es.

Reset Totalizers

byte 0: 0xXX = index input
byte 1: 0x0A = **10(dec)** index output

byte 2: 0x06 → Command

---

es.

Reading current type language of the Flow Meter

byte 0: 0x20 = **32(dec)** index input → see **INDEX Input = 32(dec)**
byte 1: 0x0A = **10(dec)** index output

byte 2: 0x07 → Command

---

es.

Writing the type language in the Flow Meter after the firsly reading of the current language set in the meter

byte 0: 0x20 = **32(dec)** index input → see **INDEX Input = 32(dec)**
byte 1: 0x0A = **10(dec)** index output

byte 2: 0x60 = **96(dec)** Command for set language

byte 3: 0x01 → set italian language in the meter

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es.

Set Autozero Calibration

byte 0: 0xXX = index input
byte 1: 0x0A = **10(dec)** index output

byte 2: 0x32 → Command

INDEX Output = 20(dec) Setting Data and Time in the Flow Meter (only for ML 210)

byte 0: (8 bits integer) INDEX Input: the value set the type of the Input data
byte 1: (8 bits integer) INDEX Output = 20(dec)
byte 2-5: 32 bits long integer containing the date and time expressed in minutes starting from 01-01-1992 the most significant byte must be sent first.

INDEX Output = 40(dec) Batch Commands

For to use the batch function it is firstly necessary to set ON the menu Batch in the Flow Meter (see the Flow Meter Manual)

byte 0: (8 bits integer) INDEX Input: the value set the type of the Input data
byte 1: (8 bits integer) INDEX Output = 40(dec)
byte 2: (8 bits integer) batch **Command**

0x10(hex) Read the batch data memory, the data are returned with the **INDEX Input = 40(dec)**

byte 3: (8 bits integer) batch **Code**

bits 0..4 = number of the batch memory to be read (0..15)
bit 5 = must be set to **zero**
bit 6 = **1** if this batch memory must be set as active batch process, **0** if this batch memory is to be read only.
bit 7 = must be set to **zero**

0x12(hex) Set batch with the code in the byte 3

byte 3: (8 bits integer) batch **Code**

Type of command that is possible to insert in the byte 3:
0x01(hex) = command for reading the current batch status (see **INDEX Input = 40(dec) or 42(dec)** for to read the status)
0x02(hex) = command for starting the current batch process
0x03(hex) = command for suspending the current batch process
0x04(hex) = command for resetting the current batch process

0x13(hex) Read the batch parameters, the data are returned with the **INDEX Input = 42(dec)**

es. Reading Batch Data:

byte 0: 0x28 = **40(dec)** index input → see **INDEX Input = 40(dec) Batch Data**
byte 1: 0x28 = **40(dec)** index output

byte 2: 0x10 → Command
byte 3: 0x40 → Code for read the first recipe and set it as the current

---

es. Batch Commands:

byte 0: 0x28 = **40(dec)** index input → see **INDEX Input = 40(dec) Batch Data**
byte 1: 0x28 = **40(dec)** index output

byte 2:0x12 → Command
byte 3:0x01 → Code Read Status
0x02 → Code Start Batch
0x03 → Code Stop Batch
0x04 → Code Reset the current Batch process

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es. Reading Batch Parameters:

byte 0: 0x2A = **42(dec)** index input → see **INDEX Input = 40(dec) Batch Data**
byte 1: 0x28 = **40(dec)** index output

byte 2: 0x13 → Command

INDEX Output = 41(dec) Setting Batch Data Memory

With this index it is possible to insert the batch data memory

byte 0: (8 bits integer) INDEX Input: the value set the type of the Input data
byte 1: (8 bits integer) INDEX Output = 40(dec)
byte 2: (8 bits integer) batch code:

bits 0..4 = number of the batch memory to be written (0..15)
bit 5 = must be set to **one**
bit 6 = **1** if this batch memory must be set as active batch process, **0** if this batch memory is to be written only.
bit 7 = must be set to **zero**

bytes 4-11: (8 bytes ASCII) memory batch name (allowed characters: 0..9, a..z, A..Z, space (32 DEC, 20 HEX))
bytes 12-13: (2 bytes 16 bit unsigned integer, MSB first) number of batch processes done for this batch memory.
bytes 14-15: (2 bytes 16 bit unsigned integer, MSB first) value of the safety batch timer expressed in tenths of seconds.
bytes 16-19: (4 bytes 32 bits unsigned long integer, MSB first) batch quantity value expressed in the same units and with the same decimal digits of the volume counters.
es.

Insertion of the Batch Data (insertion of the data in the meter is in real time for this type of data):

byte 0: 0x28 = **40(dec)** index input → see **INDEX Input = 40(dec) Batch Data**
byte 1: 0x29 = **41(dec)** index output

byte 2: 0x60 → set the first memory as the current recipe

byte 3: 0x00 → byte alignment

byte 4: 0x41
byte 5: 0x42
byte 6: 0x43
byte 7: 0x44
byte 8: 0x45
byte 9: 0x46
byte 10: 0x47
byte 11: 0x48 → recipe name: "ABCDEFGH"

byte 12: 0x00
byte 13: 0x00 → 0(dec) value for reset the counter

byte 14: 0x00
byte 15: 0x0F → 15 (dec) safety batch timer

byte 16: 0x00
byte 17: 0x00
byte 18: 0x00
byte 19: 0x01 → 1(dec) batch quantity

INDEX Output = 42(dec) Setting Batch Parameters

With this index it is possible to insert the batch parameters

byte 0: (8 bits integer) INDEX Input: the value set the type of the Input data
byte 1: (8 bits integer) INDEX Output = 42(dec)
byte 2: (8 bits integer) menu Measure – cut-off es. 1(dec) / 10 = 0.1%, 255(dec) / 10 → 25.5%
byte 3: (8 bits integer) menu Batch - N.samples
byte 4: (8 bits integer) menu Batch – Diff.thr
bytes 6-7: (2 bytes 16 bit unsigned integer, MSB first) menu Batch – V.com (value expressed in the same units and with the same decimal digits of the volume counters)
bytes 8-9: (2 bytes 16 bit unsigned integer, MSB first) menu Batch – V.pre (value expressed in the same units and with the same decimal digits of the volume counters)

es.

Insertion of the parameters value:

byte 0: 0xXX index input
byte 1: 0x2A = **42(dec)** index output

byte 2: 0x01 → cut-off (menu Measure) = 0.1%

byte 3: 0x02 → N.samples (menu Batch) = 2

byte 4: 0x03 → Diff.thr (menu Batch) = 3%

byte 5: 0x00 → byte alignment

byte 6: 0x00
byte 7: 0x04 → V.com (menu Batch) = 00.004

byte 8: 0x00
byte 9: 0x05 → V.pre (menu Batch) = 00.005

INDEX Output = 43(dec) Setting Batch Data and Batch Parameters with only this index

With this index it is possible to insert the batch data and batch parameters at the same time.

byte 0: (8 bits integer) INDEX Input: the value set the type of the Input data
byte 1: (8 bits integer) INDEX Output = 43(dec)

bytes 2-3: (2 bytes 16 bit unsigned integer, MSB first) number of batch processes done for this batch memory.
bytes 4-5: (2 bytes 16 bit unsigned integer, MSB first) value of the safety batch timer expressed in tenths of seconds.
bytes 6-9: (4 bytes 32 bits unsigned long integer, MSB first) batch quantity value expressed in the same units and with the same decimal digits of the volume counters.
byte 10: (8 bits integer) menu Measure – cut-off es. 1(dec) / 10 = 0.1%, 255(dec) / 10 → 25.5%
byte 11: (8 bits integer) menu Batch - N.samples
byte 12: (8 bits integer) menu Batch – Diff.thr
bytes 14-15: (2 bytes 16 bit unsigned integer, MSB first) menu Batch – V.com (value expressed in the same units and with the same decimal digits of the volume counters)
bytes 16-17: (2 bytes 16 bit unsigned integer, MSB first) menu Batch – V.pre (value expressed in the same units and with the same decimal digits of the volume counters)

NOTE: The only recipe that is possible to use for this index **INDEX Output = 43(dec)** is the 00 in the

meter and the name utilized for this recipe is PROFIBUS.

es.

Insertion of the parameters value:

byte 0: 0xXX index input
byte 1: 0x2A = **43(dec)** index output

byte 2: 0x00
byte 3: 0x00 → 0(dec) value for reset the counter

byte 4: 0x00
byte 5: 0x0F → 15 (dec) safety batch timer

byte 6: 0x00
byte 7: 0x00
byte 8: 0x00
byte 9: 0x01 → 1(dec) batch quantity

byte 10: 0x01 → cut-off (menu Measure) = 0.1%

byte 11: 0x02 → N.samples (menu Batch) = 2

byte 12: 0x03 → Diff.thr (menu Batch) = 3%

byte 13: 0x00 → byte alignment

byte 14: 0x00
byte 15: 0x04 → V.com (menu Batch) = 00.004

byte 16: 0x00
byte 17: 0x05 → V.pre (menu Batch) = 00.005

3.1 DPV1 ACYCLIC DATA EXCHANGE

The software of the module implement the DP standard/DPV1 functionality for communication of the slave with a Class 1 (parameterization) Master and a Class 2 Master.

With the **Acyclic Service** of data exchange and with the **Acyclic Slot** and **Acyclic Index** it is possible to send and return configuration parameters from the Flow meter with a Class 1 (parameterization) Master and a Class 2 Master.
For the communication with a Class C1 master the **Slot** is **ignored**.
Only **Slot 0** is used for the **Acyclic Service** of data exchange for the comunication with a Class 2 master.

3.2 Acyclic Read Data from the Flow Meter

For return data with the Acyclic Read Service and a Class 1 Master the **Acyclic Slot** is ignored and every value is not checked in the slave. The only value used for select the data is the **Acyclic Index**.
If the master is a Class 2 master, it is necessary insert the value of the **Acyclic Slot** = 0 and with the value of the **Acyclic Index** there is the selection of the data returned.
Below there is the description list of the type of the bytes returned with the different value inserted in the **Acyclic Index**.

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Acyclic Index Read = 20(dec) Static Process Data of the Flow Meter

bytes 0-3: (32 bit single precision IEEE floating point, MSB first) Flow rate scale range in t.u.
bytes 4-8: (5 bytes ASCII) flow rate measurement unit
bytes 9-11: (3 bytes ASCII) measurement unit of the counters
byte 12: (8 bits integer) number of decimals after the point for totalizers display
byte 13: (8 bits integer) number of decimals after the point for flow rate display
bytes 14-17: (32 bit long integer, MSB first) clock expressed in minutes starting from 01-01-1992
byte 18: (8 bits integer) measurement samples per second (Hz)

byte 20=10(dec)	measurement frequency = 10 Hz
byte 20=20(dec)	measurement frequency = 20 Hz
byte 20=50(dec)	measurement frequency = 50 Hz
byte 20=80(dec)	measurement frequency = 80 Hz
byte 20=150(dec)	measurement frequency = 150 Hz
byte 20=44(dec)	measurement frequency = 300 Hz
byte 20=144(dec)	measurement frequency = 400 Hz

byte 19: (8 bits integer) current value of Data Type (see the Sections Data Type and the relative Configuration)

NOTE: The values in the "32 bits single precision IEEE floating point" format are floating point numbers which can be represented during writing by any decimal digits. To keep the same numerical format visible on the instrument display however, it is necessary to calculate the decimal figures with a rather complex algorithm which takes account of instrument precision, flow rate measurement unit, etc. For this purpose and to avoid useless calculations, the number of decimals to use to represent the flow rate values is supplied separately (byte position 13).

NOTE: The counters are expressed with a 32 bit integer. The «counter decimal figures» parameter, indicates the point position starting from the right: 0 = no decimal, 1=1 decimal figure, and so on (byte position 12).

NOTE: The date and time are expressed with a 32 bit integer containing the number of minutes elapsed since 01-01-1992. To calculate the date starting from this number, see the programming examples in the section 4.0 PROGRAMMING ALGORITMS of this manual.

Acyclic Index Read = 21(dec) Slave Data

byte 0: (8 bits integer) enabled/disabled the control of the flow rate by thresholds and sending Diagnostic message (see Section 1.5 Slave Diagnostic Alarms)

bit 0 =1 if enabled the control of the flow rate by thresholds and sending Diagnostic message

byte 1: (8 bits integer) enabled/disabled Alarm message when the control of the flow rate by thresholds is active

bit 0 =1 if enabled the sending of Alarm message when the control of the flow rate by thresholds is active

byte 2: (8 bits integer) slave address
byte 3: (8 bits integer) pno ident number high
byte 4: (8 bits integer) pno ident number low
byte 5: (8 bits integer) DPC31 ASIC Step

bit 0 =1 if DPC31 B

byte 6: (8 bits integer) MAC State Offline / Passive Idle

bit 0 =1 if the MAC is in Passive Idle

byte 7: (8 bits integer) watchdog state

bit 0-1 = 00 --> Baud Search
01 --> Baud Control
10 --> DP_Control

byte 8: (8 bits integer) baud rate

bit 0-3 = 0000 --> 12 MBd
0001 --> 6 MBd
0010 --> 3 MBd
0011 --> 1.5 MBd
0100 --> 500 kBd
0101 --> 187.5 kBd
0110 --> 93.75 kBd
0111 --> 45.45 kBd
1000 --> 19.2 kBd
1001 --> 9.6 kBd

byte 9: (8 bits integer) DP state machine

bit 0-1 = 11 --> Data_Exchange

Acyclic Index Read = 22(dec) Internal Data

byte 0: (8 bits integer) slave software version (major number)
byte 1: (8 bits integer) slave software version (minor number)
byte 2: (8 bits integer) current language set in the Flow meter

Format of the returned data:

0(dec) = English
1(dec) = Italian
2(dec) = French
3(dec) = Spanish

NOTE: For reading the type of language it is first necessary to send to the slave the relative command, see the **Acyclic Index Read = 10** (below in this section) and then read the type of language in the byte 2.

byte 3-8: (8 bits integer) device name («ML 210», «ML M3F»)
byte 9: (8 bits integer) Flow meter software version (major number)
byte 10: (8 bits integer) Flow meter software version (minor number)
byte 11-12: (8 bits integer) (16 bits unsigned integer, byte 13=MSB):
hardware / software enabling flags, bit 0 = LSB, bit 15 = MSB:

bits	Functions ML 210/M3F
0-2	current access level (0..7)
3	channel 1 impulses in use
4	channel 2 impulses in use
5	channel 1 frequency in use
6	channel 2 frequency in use
7	scale range 2 in use
8	specific weight in use
9	additional output 3 present
10	additional output 4 present
11	output 4..20 mA 2 present
12	RS232 present
13	batching functions active
14	output 4..20 mA 2 present
15	RS485 present

Acyclic Index Read = 30(dec) Batch Functions

byte 0: (8 bits integer) batch status:

Format of the returned data: 1 byte containing the batch process state:
0(dec) = batch process is correctly terminated (pre-set quantity reached).
1(dec) = batch process is running (the valve is opened and the counters are running).
2(dec) = batch process is suspended (the valve is closed before the pre-set quantity is reached).

bytes 1-8: (8 bytes ASCII) memory batch name (allowed characters: 0..9, a..z, A..Z, space (32 DEC, 20 HEX))
bytes 9-10: (2 bytes 16 bit unsigned integer, MSB first) number of batch processes done for this batch memory.
bytes 11-13: (2 bytes 16 bit unsigned integer, MSB first) value of the safety batch timer expressed in tenths of seconds.
bytes 14-17: (4 bytes 32 bits unsigned long integer, MSB first) batch quantity value expressed in the same units and with the same decimal digits of the volume counters.

Acyclic Index Read = 50(dec) Data Logger DATA

byte 0: (8 bits integer) check **DATA** on Internal Data Logger

bit 0 =1 Presence of data in the Internal Data Logger

Acyclic Index Read = 51(dec) Data Logger DATA

byte 0: (8 bits integer) number of record requested
byte 1: (8 bits integer) total number of records present in the memory
bytes 2-5: (32 bits long integer, MSB first) data saving time and date expressed in minutes starting from 01-01-1992
bytes 6-9: (32 bits long integer, MSB first) data counted +
bytes 10-13: (32 bits long integer, MSB first) data counted -
bytes 14-17: (32 bit single precision IEEE floating point, MSB first) flow rate in technical unit
bytes 18-20: (3 bytes ASCII) counter measurement unit

byte 21: (8 bits integer) number of decimal figures after the point for counter display
bytes 22-26: (5 bytes ASCII) flow rate measurement unit
byte 27: (8 bits integer) number of decimals after the point for flow rate display

Acyclic Index Read = 52(dec) Data Logger EVENTS

byte 0: (8 bits integer) check **EVENTS** on Internal Data Logger

bit 0 =1 Presence of Events in the Internal Data Logger

Acyclic Index Read = 53(dec) Data Logger EVENTS

byte 0: (8 bits integer) number of record requested
byte 1: (8 bits integer) total number of records present in the memory
es 2-5: (32 bits long integer, MSB first) data saving time and date expressed in minutes starting from 01-01-1992
bytes 6-9: (32 bits long integer, MSB first) Events

if bytes 6-9 = 0(dec) then NO ALARMS

if bytes 6-9 = 196863(dec) then SYSTEM STARTUP

if bytes 6-9 = 262143(dec) then SYSTEM STARTUP

else

bit 0 = 1 Batch alarm
bit 1 = 1 Alarm Max Flow
bit 2 = 1 Alarm Min Flow
bit 3 = 1 Alarm Measure > Full Scale
bit 4 = 1 Alarm Pulse/Frequency > Full Scale
bit 5 = 1 Input Noisy
bit 6 = 1 Empty Pipe
bit 7 = 1 Excitation Fail
bit 8 = 1 not used
bit 9 = 1 not used
bit 10 = 1 not used
bit 11 = 1 not used
bit 12 = 1 not used
bit 13 = 1 not used
bit 14 = 1 not used
bit 15 = 1 not used
bit 16 = 1 Current Loop Open
bit 17 = 1 Power Supply Fail

Acyclic Index Read = 54(dec) Data Logger MIN MAX measurement unit

bytes 0-4: (5 bytes ASCII) flow rate measurement unit
byte 5: (8 bits integer) number of decimals after the point for flow rate display

Acyclic Index Read = 55(dec) Data Logger MIN MAX data

bytes 0-4: (32 bit single precision IEEE floating point, MSB first) flow rate MAX
bytes 5-8: (32 bit single precision IEEE floating point, MSB first) flow rate MI

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Acyclic Index Read = 100(dec) Current value of the High Alarm Threshold for the Flow rate Control with Diagnostic and Alarm

bytes 0-3: High Alarm Threshold (32 bit single precision IEEE floating point, MSB first) Flow rate in technical unit

Acyclic Index Read = 101(dec) Current value of the High Warning Threshold for the Flow rate Control with Diagnostic and Alarm

bytes 0-3: High Warning Threshold (32 bit single precision IEEE floating point, MSB first) Flow rate in technical unit

Acyclic Index Read = 102(dec) Current value of the Low Warning Threshold for the Flow rate Control with Diagnostic and Alarm

bytes 0-3: Low Warning Threshold (32 bit single precision IEEE floating point, MSB first) Flow rate in technical unit

Acyclic Index Read = 103(dec) Current value of the Low Alarm Threshold for the Flow rate Control with Diagnostic and Alarm

bytes 0-3: Low Alarm Threshold (32 bit single precision IEEE floating point, MSB first) Flow rate in technical unit

3.2. Acyclic Write Data to the Flow Meter

For the insertion of the data with the Acyclic Read Service and a Class 1 Master the **Acyclic Slot** is ignored and every value is not checked in the slave. The only value used for select the type of data inserted is the **Acyclic Index**.
If the master is a Class 2 master, it is necessary insert the value of the **Acyclic Slot** = 0 and with the value of the **Acyclic Index** there is the indication to the slave of the type of data of the data inserted.
Below there is the description list of the type of the bytes that there is possible to insert with the different value inserted in the **Acyclic Index**.

Acyclic Index Write = 0(dec) Setting of the value of the Data Type

byte 0: (8 bits integer) Data Type (see the Sections **Data Type** and the relative Configuration)

Acyclic Index Write = 10(dec) Flow Meter Commands

byte 0: (8 bits integer) command type

Type of command that is possible to insert in the byte 0:

Byte 0 = **0x06(hex)** command for reset the Totalizers of the Flow Meter (see the Flow Meter Manual and the relative menu for to enable which totalizers to reset by this command).

Byte 0 = **0x07(hex)** command for read the current Language used in the Flow Meter:
The information is returned by the byte 2 of the Input data with Acyclic Index 22.

Byte 0 = **0x08(hex)** command for Reset the slave module. After 5 seconds the module return in the data exchange

Byte 0 = **0x32(hex)** command for Autozero Calibration

Acyclic Index Write = 11(dec) Command for Set Language in the Flow Meter

Command for set the type of language in the meter (Note: It is firstly necessary to read the type of the language of the meter, for to set it with this command)

Byte 0 = type of language:

0x00 = 0(dec) = English
0x01 = 1(dec) = Italian
0x02 = 2(dec) = French
0x03 = 3(dec) = Spanish

Acyclic Index Write = 20(dec) Setting Data and Time in the Flow Meter

byte 0-4: 32 bits long integer containing the date and time expressed in minutes starting from 01-01-1992 the most significant byte must be sent first.

NOTE: The date and time are expressed with a 32 bit integer containing the number of minutes elapsed since 01-01-1992. To calculate the date starting from this number, see the programming examples in the section 4.0 PROGRAMMING ALGORITMS of this manual.

Acyclic Index Write = 21(dec) Enable/Disable Flow rate Control with Diagnostic message and Alarms

byte 0: (8 bits integer) enable/disable Flow meter control with thresholds and Diagnostic message

Type of command that is possible to insert in the byte 0:
0 = Control of the Flow rate disabled
1 = Control of the Flow rate enabled, if the value of the Flow rate exceed one of the four thresholds the slave send the relative Diagnostic message

byte 1: (8 bits integer) enable/disable Process Alarm message

Type of command that is possible to insert in the byte 1:
0 = Alarms disabled
1 = Alarms enabled, if the value of the Flow rate exceed one of the four thresholds the slave send Process Alarm message

Acyclic Index Write = 30(dec) Batch Commands

For to use the batch function it is firstly necessary to set ON the menu Batch in the Flow Meter (see the Flow Meter Manual)

byte 0: (8 bits integer) batch **Command**

0x10(hex) Read the batch data memory, the data are returned with the **Acyclic Index Read 30**
0x11(hex) Write the batch data memory, the data are firstly inserted with **Acyclic Index Write 31**
0x12(hex) Set batch with the code in the byte 1

byte 1: (8 bits integer) batch **Code**

Type of command that is possible to insert in the byte 1:
0x01(hex) = command for reading the current batch status (see **Acyclic Index Read 30** for to read

the status)
0x81(hex) = command for starting the current batch process
0x82(hex) = command for suspending the current batch process
0x83(hex) = command for resetting the current batch process

Acyclic Index Write = 31(dec) Setting Batch Data Memory

With this index it is possible to insert the batch data memory, and then with the Acyclic Index Write = 30 and the batch command 0x11(hex) the data is written in the Flow meter

byte 0: (8 bits integer) batch code:

bits 0..4 = number of the batch memory to be written (0..15)
bit 5 = must be set to **one**
bit 6 = **1** if this batch memory must be set as active batch process, **0** if this batch memory is to be written only.
bit 7 = must be set to **zero**

bytes 1-8: (8 bytes ASCII) memory batch name (allowed characters: 0..9, a..z, A..Z, space (32 DEC, 20 HEX))
bytes 9-10: (2 bytes 16 bit unsigned integer, MSB first) number of batch processes done for this batch memory.
bytes 11-12: (2 bytes 16 bit unsigned integer, MSB first) value of the safety batch timer expressed in tenths of seconds.
bytes 13-16: (4 bytes 32 bits unsigned long integer, MSB first) batch quantity value expressed in the same units and with the same decimal digits of the volume counters.

Acyclic Index Write = 50(dec) Data Logger Commands

With this index it is possible to insert the number of record requested for to return the data in the internal Data Logger, and then with the Acyclic Indexes Read = 50,51...55 it is posssible read the data returned

byte 0: (8 bits integer) number of record requested
byte 1: (8 bits integer) command type

byte 1 = 0x20(hex) command for check presence of DATA in the Internal Data Logger
byte 1 = 0x21(hex) command for reading record of DATA from the Internal Data Logger
byte 1 = 0x22(hex) command for erasing DATA in the Internal Data Logger
byte 1 = 0x23(hex) command for check presence of EVENTS in the Internal Data Logger
byte 1 = 0x24(hex) command for reading record of EVENTS in the Internal Data Logger
byte 1 = 0x25(hex) command for erasing EVENTS in the Internal Data Logger
byte 1 = 0x26(hex) command for reading measurement unit of the MIN MAX in the Internal Data Logger
byte 1 = 0x27(hex) command for reading values MIN MAX from the Internal Data Logger
byte 1 = 0x28(hex) command for erasing MIN MAX values in the Internal Data Logger

Acyclic Index Write = 100(dec) Setting the value of the High Alarm Threshold for the Flow rate Control with Diagnostic and Alarm

bytes 0-3: High Alarm Threshold (32 bit single precision IEEE floating point, MSB first) Flow rate in technical unit

Acyclic Index Write = 101(dec) Setting the value of the High Warning Threshold for the Flow rate Control with Diagnostic and Alarm

bytes 0-3: High Warning Threshold (32 bit single precision IEEE floating point, MSB first) Flow rate in technical unit

Acyclic Index Write = 102(dec) Setting the value of the Low Warning Threshold for the Flow rate Control with Diagnostic and Alarm

bytes 0-3: Low Warning Threshold (32 bit single precision IEEE floating point, MSB first) Flow rate in technical unit

Acyclic Index Write = 103(dec) Setting the value of the Low Alarm Threshold for the Flow rate Control with Diagnostic and Alarm

bytes 0-3: Low Alarm Threshold (32 bit single precision IEEE floating point, MSB first) Flow rate in technical unit

4.1 PROGRAMMING ALGORITHMS

The following algorithms can be applied to IBM™ compatible personal computers. The programs demonstrated are written in BASIC and are supplied as examples only. The program lines are highlighted in bold face and the comments are in italics.

4.2 NUMERICAL CONVERSION OF THE DATA RECEIVED

The numerical data contained in the blocks received must be concerted into a format compatible with the PC format. The arrangement of bytes used to represent numerical values in IBM™ compatible PCs is in fact inverted with respect to the one in the data received. The following programs illustrate several of the ways that can be used for these conversions.
We presume that there are bytes to convert in the variable - type Bytes$ string.

- Converting a byte or a group of ***ASCII*** characters: no conversion is necessary, the data are already in the exact order and format.

- Converting a ***16 bit signed word***: Bytes contains the two bytes that constitute the 16 bit number to convert. One 16 bit signed word can represent values from -32768 to 32767. The instructions to use may be the following:
NumIntSgn%=CVI(MID$(Bytes$,2,1)+MID$(Bytes$,1,1))

- Converting a ***16 bit unsigned word***: Bytes contains the two bytes that constitute the 16 bit number to convert. One 16 bit unsigned word can represent values from 0 to 65535. Not all BASIC versions can correctly manage this type of variable; we therefore recommend assigning the converted value to a long integer 32 bit type variable or to a single precision floating point. The instructions to use (for the long integer) are:
NumInt&=CVL(MID$(Bytes$,2,1)+MID$(Bytes$,1,1)+ CHR$(0)+CHR$(0))

- Converting a 32 bit long integer: Bytes contains the four bytes that constitute the 32 bit number to convert. A 32 bit integer may represent values from -2147483648 to 2147483647. The instructions to use may be the following:
NumInt&=CVL(MID$(Bytes$,4,1)+MID$(Bytes$,3,1)+MID$(Bytes$,2,1)+MID$(Bytes$,1,1))

- Converting a 32 bit decimal value (***32 bit floating point IEEE standard)***: Bytes contains the four bytes that constitute the 32 bit number to convert. A 32 bit decimal number can represent values from ±1.4E-45 to ±3.4E+38. The instructions to use may be the following:
NumFlt!=CVS(MID$(Bytes$,4,1)+MID$(Bytes$,3,1)+MID$(Bytes$,2,1)+MID$(Bytes$,1,1))

NOTE: Some old versions of BASIC do not support the **CVL** instruction and the 32 bit integer format.

4.3 DATE CONVERSION FROM TOTAL MINUTES TO DAY/MONTH/YEAR HOURS:MINUTES

The date read by the Millennium series instruments is expressed in minutes starting from 01/01/1992. The following program executes the conversion of the value in minutes contained in the 32 bit integer variable MinTot and prints it in the day/month/year hours:minutes format.

Note the use of suffixes "%" and "&" to respectively indicate the 16 and 32 bit variables. Both types are necessary to optimise the calculations and to contain the values which cannot be expressed in just 16 bits.

```
10 REM  Length in days for each month in the year
20 DATA 31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31
30 REM  Defines a group of twelve elements to memorise the length in days of each month in
40 REM  the year
50 DIM LengthMonths%(12)
60 REM  Initialises each element of the group
70 FOR i% = 1 TO 12: READ LengthMonths%(i%): NEXT i%
80 REM  Calculates the total number of days
90 Days& = INT(MinTot& / 1440)
100 REM Calculates the minutes
110 n& = MinTot& MOD 1440
120 Minutes& = n& MOD 60
130 REM Calculates the hours
140 Hour& = INT(n& / 60)
150 REM Calculates the number of leap years. 4 years are 1460 days + 1
160 n& = INT(Days& / 1461)
170 REM Calculates the remaining days, not exact multiples for a period of 4 years
180 m& = Days& MOD 1461
190 REM Determines the p and q correction values for leap years
200 IF m& = 0 THEN q% = 1 ELSE q% = 0
210 IF m& > 365 THEN p% = 1 ELSE p% = 0
220 REM Calculates the total number of years
230 Years& = INT(n& * 4 + (m& - 1 + q%) / 365)
240 REM Calculates the remaining days, not exact multiples of one year
250 Days& = Days& - Years& * 365 - n& - p%
260 REM Determines if the year calculated is a leap year, in this case m = 0
270 m& = Years& AND 3
280 REM Calculates the number of the month and removes the sum of the preceding
290 REM months from the remaining days.
300 FOR i% = 1 TO 12
310 Months% = LengthMonths%(i%)
320 REM If it is February and the year is a leap year, add one day
330 IF i% = 2 AND m& = 0 THEN Months% = Months% + 1
340 REM Continues the cycle until the number of days remaining is lower than the
350 REM length of the month compared
360 IF Days& >= Months% THEN Days& = Days& - Months%: ELSE GO TO 380
370 NEXT
380 REM Assigns the number of the month thus calculated to the variable
390 Months% = i%
400 REM Adjusts the value of the days calculated
```

410 Days& = Days& + 1
420 REM Determines the last two digits of the year
430 Years& = (Years& + 92) MOD 100
440 REM Finally prints the complete date
450 PRINT Days&; "/"; Months%; "/"; Years&; " "; Hours&; ":"; Minutes&

NOTE: Some old versions of BASIC do not support the 32 bit integer format.

4.4 DATE CONVERSION FROM DAY/MONTH/YEAR HOURS:MINUTES TO TOTAL MINUTES

The date we can set serially in the Millennium series instruments must be expressed in total minutes starting from 01/01/1992. The program that performs the conversion from a string of 14 characters (AsciiData) in the day/month/year hours:minutes format, transforms it into 4 formatted characters ready to be sent to the serial line (MinTot).

Note the use of suffixes "%" and "&" to respectively indicate the 16 and 32 bit variables. Both types are necessary to optimise the calculations and to contain the values which cannot be expressed in just 16 bits.

10 REM Length in days for each month of the year
20 DATA 31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31
30 REM Defines a group of twelve elements to memorise the length in days of each month in
40 REM the year
50 DIM LengthMonths%(12)
60 REM Initialises each element of the group
70 FOR i% = 1 TO 12: READ LengthMonths%(i%): NEXT i%
80 REM Takes the number of years starting from 1992
90 Years% = (VAL(MID$(AsciiData$, 7, 2)) + 8) MOD 100
100 REM Determines if the year contained in the entry string is a leap year, in this case, m = 0
110 m% = Years% AND 3
120 REM Takes the number of the month from the entry string
130 Months% = VAL(MID$(AsciiData$, 4, 2))
140 REM Calculates all the days of the year corresponding to the date of the entry string
150 Days& = VAL(MID$(AsciiData$, 1, 2))
160 FOR i% = 1 TO Mesi% - 1
170 Days& = Days& + LengthMonths%(i%)
180 REM If it is February and the year is a leap year, it adds one day
190 IF i% = 2 AND m% = 0 THEN Days& = Days& + 1
200 NEXT i%
210 REM Adds a day if the year of the entry string is not a leap year
220 IF m% <> 0 THEN Days& = Days& + 1
230 REM Calculates the total number of days corresponding to the entry date
240 Days& = Days& + (Years% * 365) + INT(Years% / 4)
250 REM Takes the number of hours and minutes from the entry date
260 Hours& = VAL(MID$(AsciiData$, 10, 2))
270 Minutes& = VAL(MID$(AsciiData$, 13, 2))
280 REM Calculates the total number of minutes to the entry date
290 Minutes& = Minutes& + (Days& * 1440) + (Hours& * 60)
300 REM Finally formats the bytes that represent the number in the right order for sending
310 MinTot$ = MKL$(Minutes&)
320 MinTot$ = MID$(MinTot$,4,1)+MID$(MinTot$,3,1)+MID$(MinTot$,2,1)+MID$(MinTot$,1,1)
NOTE: Some old versions of BASIC do not support the **MKL** instruction and the 32 bit integer format.