

# **Foundation Fieldbus Specifications**

## **Multi-parameter**

### **M400 FF**



# 1. Mettler Toledo Parameters

The following tables list the manufacturer-specific instrument parameters for the Resource Block, the Transducer Block and the Analog Input Blocks.

## 1.1 General explanatory remarks

### Data type

- DS: data structure, contains data types such as Unsigned8, Octet String etc.
- Float: IEEE 754 format
- Visible String: ASCII coded
- Unsigned:
  - Unsigned8: value range = 0 to 255
  - Unsigned16: value range = 0 to 65535
  - Unsigned32: value range = 0 to 429496729

### Storage class

- C: constant parameter
- D: dynamic parameter
- N: nonvolatile parameter
- S: static parameter

The MODE\_BLK column indicates the block mode in which the parameter can be written if the parameter is a write parameter. Some parameters can only be written in the OOS block mode. The "Reset codes" column indicates which reset codes reset the parameter.

## 2. General Specifications

Model: M400 FF Multi-parameters Fieldbus Transmitter

Device ITK Profile: 6

MANUFAC\_ID:0x465255

Device Type:0x400

Device Revision:0x01

Physical Layer Profiles:113, 511

Linkmaster:Yes

Number of Link Objects:

Mandatory Features:

- Resource Block
- Alarms and Events
- Function Block Linking
- Trending
- Multi-Bit Alert Reporting
- Field Diagnostics

Function Blocks:

- 4 \* Analog Input
- 1 \* Analog Output (Pressure Compensation)
- 2 \* Discrete Input (Alarm\Hold\Clean Status)
- 2 \* Discrete Output(System Hold, O2 Optical LED Control)
- 1 \* PID

### 3. AI Function Blocks

4 Analog Input Function Blocks provide for cyclic transmission of measured values. You can assign individual process variables from each AI channel parameter.

Example: AI1 is set to pH value, AI2 is set to temperature degC, AI3 is set to DLI, AI4 is set to TTM

Setting in AI 1:

Parameter	Value	Comments
CHANNEL	10	Ref section 3.1 for detail information
XD_SCALE, UNITS_INDEX	PH	
OUT_SCALE, UNITS_INDEX	PH	
L_TYPE	Direct	
MODE_BLK, ACTUAL	Auto	

Setting in AI 2:

Parameter	Value	Comments
CHANNEL	1	Ref section 3.1 for detail information
XD_SCALE, UNITS_INDEX	°C	
OUT_SCALE, UNITS_INDEX	°C	
L_TYPE	Direct	
MODE_BLK, ACTUAL	Auto	

Setting in AI 3:

Parameter	Value	Comments
CHANNEL	4	Ref section 3.1 for detail information
XD_SCALE, UNITS_INDEX	days	
OUT_SCALE, UNITS_INDEX	days	
L_TYPE	Direct	
MODE_BLK, ACTUAL	Auto	

Setting in AI 4:

Parameter	Value	Comments
CHANNEL	5	Ref section 3.1 for detail information
XD_SCALE, UNITS_INDEX	days	
OUT_SCALE, UNITS_INDEX	days	
L_TYPE	Direct	
MODE_BLK, ACTUAL	Auto	

Note: For parameter changes, you must set MODE\_BLK/TARGET to OOS (Out of Service) since otherwise the error message NIF\_ERR\_WRONG\_MODE\_FOR\_REQUEST would appear for [Write Changes].

### 3.1 Channel definition:

Common units	CHANNEL	Function(Description)	Display	Unit Value
	1	Temperature	° C	1001
	2	Temperature	° F	1002
	3	None	no units	1588
pH/ORP sensor	CHANNEL	Function	Unit	Unit Value
	10	pH	pH	1422
	11	mV	mV	1243
	12	ORP	mV ORP	36000
	13	RpNa	Mohm	1283
	14	Rg	Mohm	1283
	15	Rr	Kohm	1284
	4	DLI (ISM Only)	d DLI	40000
	5	TTM (ISM Only)	d TTM	40001
	6	ACT (ISM Only)	d ACT	40002
O2&O2 Optical sensor	CHANNEL	Function	Unit	Unit Value
	20	Saturation (air)	%air	34000
	21	Saturation (O2)	%O2	34001
	22	Concentration	mg/l	1608
	23	Concentration	ug/l	1689
	24	Concentration	ppm	1423
	25	Concentration	ppb	1424
	26	Volume Concentration	%O2G	34002
	27	Volume Concentration	ppmO2G	34003
	28	pressure	mbar	1138
	29	Current	nA	1213
	4	DLI (ISM Only)	d DLI	40000
	5	TTM (ISM Only)	d TTM	40001
	6	ACT (ISM Only)	d ACT	40002
	7	OptoCap (O2 Opt Only)	tooCap	40003
Cond sensor	CHANNEL	Function	Unit	Unit Value
	30	Conductivity	mS/cm	1302
	31	Conductivity	uS/cm	1586
	32	Resistivity	MOhm-cm	1587
	33	Resistivity	KOhm-cm	1604
	34	TDS NaCl	ppm	1423
	35	TDS NaCl	ppb	1424
	36	TDS NaCl	ppk	1425 (ppt)
	37	TDS CaCO3	ppm	1423
	38	TDS CaCO3	ppb	1424
	39	TDS CaCO3	ppk	1425 (ppt)
	40	Concentration	%NaOH	33000
	41	Concentration	%NaCl	33001
	42	Concentration	%H2SO4	33002
	43	Concentration	%H3PO4	33003
	44	Concentration	%HNO3	33004
	45	Concentration	%HCl	33005

	46	Concentration	%Conc	33006
	47	Conductivity	S/cm	1680
	48	Conductivity	S/m	1299
	49	Resistivity	Ohm-cm	1295
CO2 Pharma sensor	CHANNEL	Function	Unit	Unit Value
	50	%CO2		1342
	51	hPa		1136
	52	mbar		1138
	53	mmHg		1157
	54	mg/l		1608
	55	mV		1243
	4	DLI (ISM Only)	d DLI	40000
	5	TTM (ISM Only)	d TTM	40001
	6	ACT (ISM Only)	d ACT	40002

## 4. AO Function Blocks

Cyclic transmission of an external pressure value to transmitter for compensation. This only apply for oxygen sensor.

Please set parameter " PROC\_PRESSURE\_SOURCE" of Sensor Transducer Block to option "From FF Bus".

Note: the always set the OUT\_SCALE, UNITS\_INDEX to mbar or hPa.

## 5. DI Function Blocks

<i>DI</i>	<i>Bit</i>	<i>Meaning</i>
DI1	0	Alarm status
	1	Clean status

<i>DI</i>	<i>Bit</i>	<i>Meaning</i>
DI2	0	HOLD status

## 6. DI Function Blocks

<i>DO</i>	<i>Bit</i>	<i>Meaning</i>
DO1	0	System Hold(1 - HOLD Active, 0 - Hold Inactive)

<i>DO</i>	<i>Bit</i>	<i>Meaning</i>
DO2	0	O2 Opt LED Control ( 1 - LED OFF, 0 - LED ON)

**Note:DO2 only apply for sensor is O2 Optical sensor and LED mode is configured to "Auto".**

## 7. Standard parameter for each block

Index	Parameter	Data type	Store	Size Byte	RW	Range	Default
1	ST_REV	Unsigned16	N	2	RO	0-65535	0
2	TAG_DESC	Octedstring	S	32	R/W	32 ASCII characters	"
3	STRATEGY	Unsigned16	S	2	R/W	0-65535	0
4	ALERT_KEY	Unsigned8	S	1	R/W	1 to 255	0
5	MODE_BLK 1 Target 2 Actual 3 Permitted 4 Normal	DS-37 Unsigned8 Unsigned8 Unsigned8 Unsigned8	D	4	R	OOS,MAN and Auto	Depend block
6	BLOCK_ERR		D		R	0 - Inactive 1 - Active	
7	UPDATE_EVT						
8	BLOCK_ALARM	DS-42	D	8	R		
9	TRANSDUCER_DIRECTORY						
10	TRANSDUCER_TYPE						
11	XD_ERROR						
12	COLLECTION_DIRECTORY						

\*Only function blocks carry this parameters!

## 8. General Transducer Block (BLOCK\_INDEX:600)

Index	Parameter	Data type	Store	Size Byte	RW	Writable Range	Default
1-12	FF Standard parameter						
Manufacturer-specific extensions:Measured values							
13	PRIMARY_VALUE	DS-65	D	5	R		
14	SECONDARY_VALUE	DS-65	D	5	R		
15	THIRD_VALUE	DS-65	D	5	R		
16	FOURTH_VALUE	DS-65	D	5	R		
Manufacturer-specific extensions: parameter and calibration values							
17	Sensor channel	Unsigned8	S	1	R	Analog = 0 ISM = 1	
18	Sensor type	Unsigned8	N	1	RW	1-Analog pH/ORP 3-Analog Cond2e 4-Analog Cond4e 5-Analog O2 Hi 6-Analog O2 Lo 7-Analog O2 Trace	

						129-ISM pH/ORP 130-ISM pH/pNa 131-ISM Cond2e 132-ISM Cond4e 133-ISM O2 Hi 134-ISM O2 Lo 135-ISM O2 Trace 136-ISM ppmO2G 137-ISM O2 Optical	
19	Auto_Recognize	Unsigned8	N	1	RW	1 – Yes 0 – No	1 (only valid when sensor type is ISM)
20	PV average	Unsigned8	N	1	RW	0 - None 1 - Low 2 - Medium 3 - High 4 - Special	4
21	SV average	Unsigned8	N	1	RW	Same as PV average	4
22	TV average	Unsigned8	N	1	RW	Same as PV average	4
23	QV average	Unsigned8	N	1	RW	Same as PV average	4
24	Device Date&Time	DATE	N	7	RW	2008.1.1-2099.12.30	2008.1.1
25	Alarm setting	Bits	N	4	RW	01 - DLI 02 - TTM 03 - ACT 04 - CIP 05 - SIP 06 - Autoclave 07 - Glass resistance 08 - Reference resistance 09 - Cell constant deviation 10 - Electrolyte level 11 - Software failure 12 - Sensor disconnected 13 - Shaft error 14 - Signal error	

## 9. Sensor Transducer Block (BLOCK\_INDEX:700)

Index	Sub-Index	Parameter	Data type	Store	Size Byte	RW	Writable Range	Default
1-12		Standard parameter						
<b>Mettler-Toledo Specific Parameters</b>								
13		Sensor_chanel	Unsigned8	N	1	R	Analog = 0 ISM = 1	
14		Sensor Type	Unsigned8	N	1	R	1-Analog pH/ORP 3-Analog Cond2e 4-Analog Cond4e 5-Analog O2 Hi 6-Analog O2 Lo 7-Analog O2 Trace  129-ISM pH/ORP 130-ISM pH/pNa	

							131-ISM Cond2e 132-ISM Cond4e 133-ISM O2 Hi 134-ISM O2 Lo 135-ISM O2 Trace 136-ISM ppmO2G 137-ISM O2 Optical	
<b>15</b>	<b>Temperature Parameters</b>							
	1	RTD_TYPE	Unsigned8	N	1	RW	0 - Auto(DEFAULT) 1 - NTC22K 2 - Pt1000 3 - Pt100 4 - Fixed	0(for analog channel only)
	2	Meas Fixed	Float	N	4	RW	-40 to 200	25° C(for analog pH only)
	3	Cal Fixed	Float	S	4	RW	-40 to 200	25° C(for analog pH only)
	4	RTD Raw value	Float	D	4	R		
	5	RTD Raw Unit	Unsigned16	D	2	R	°C - 1001 Ohm - 1281	
<b>16</b>	<b>Calibration Parameters</b>							
	1	Drift	Unsigned16	N	2	R/W	0 - Auto 1 - Manual	
	2	Cal Temporary Slope	Float	S	4	R		
	3	Cal Temporary Offset	Float	S	4	R		
	4	Cal-Point	Float	S	4	W		
	5	Calibration Unit Code	Unsigned16	S	2	W		
	6	Calibration Finish Flag	Unsigned16	S	2	W	0 - NOP(no operation) 1 - Finished	
	7	Calibration Point	Unsigned16	S	2	W	0 - First Point 1 - Second Point	
	8	MeasCal_Action	Unsigned16	S	2	W	0 - NOP(no operation) 1 - ENTRY Action	
	9	MeasCal_Point	Unsigned16	S	2	W	0 - First Point 1 - Second Point	
	10	Calibration Mode	Unsigned16	S	2	W	0 - exit calibration 1 - pH 1 point 2 - pH 2 point 3 - pH Process 4 - ORP 1 Point 18 - ORP Process 5 - O2 Process Slope 6 - O2 Process Offset 7 - O2 1 Point Slope 8 - O2 1 Point Offset 9 - Conductivity 1 Point 10 - Conductivity 2 Point 11 - Conductivity Process 12 - Resistivity 1 Point 13 - Resistivity 2 Point 14 - Resistivity Process	

							15 - O2 Optical 1 point 16 - O2 Optical 2 point 17 - O2 Optical Process	
	11	Calibration Status	Unsigned16	D	2	R		
	12	Cal Value	Float	D	4	R		
	13	Unit code for Cal Value	Unsigned16	D	2	R		
<b>17</b>	<b>PH Parameters</b>							
	1	PH BUFFER	Unsigned8	N	1	RW	0 - Mettler-9(default) 1 - Mettler-10 2 - Nist-Tech 3 - Nist-Std 4 - Hach 5 - Ciba 6 - Merck 7 - WTW 8 - None 9 - JIS Z 8802 10 - Na+3.9M(for pH/pNa)	0
	2	STC Ref Mode	Unsigned8	N	1	RW	0 - Yes 1 - No(DEFAULT)	1
	3	pH Slope Display Unit	Unsigned8	N	1	RW	0 - percent(DEFAULT) 1 - mv/pH	
	4	pH Offset Display Unit	Unsigned8	N	1	RW	0 - pH(DEFAULT) 1 - mV	
	5	STC Ref Temperature	Float	N	4	RW	-40 to 200 ° C	25
	6	STC Ref Value	Float	N	4	RW		0 pH/°C
	7	IP	Float	N	4	RW	-2 – 16 pH	7pH
	8	Raw mV	Float	D	4	RW	Unit:mV	
	9	Raw ORP	Float	D	4	RW	Unit:mV	ISM pH only
	10	Raw Rr	Float	D	4	RW	Unit:Kohm	pH sensor Only
	11	Raw Rg	Float	D	4	RW	Unit:Mohm	
	12	Raw RpNa	Float	D	4	RW	Unit:Mohm	ISM pH/pNa only
<b>18</b>	<b>O2,oDo Parameters</b>							
	1	Cal Pressure Unit	Unsigned16	N	2	RW	1157 - mmHg 1133 - kPa 1136 - hPa 1138 - mbar 1141 - psi	1157-mmHg
	2	Cal Pressure	Float	N	4	RW		759.8 mmHg
	3	Proc Pressure Source	Unsigned8	N	1	RW	0 - Edit(DEFAULT) 1 - Local Ain 2 – FF Bus	
	4	Proc Cal Pressure Source	Unsigned8	N	1	RW	0 - Cal Pressure 1 - Proc Pressure	1
	5	Proc Pressure Unit	Unsigned16	N	2	RW	1157 - mmHg 1133 - kPa	1157-mmHg Valid when Proc Pressure Source is

							1136 - hPa 1138 - mbar 1141 - psi	Local Edit
	6	Proc Pressure	Float	N	4	RW		759.8 mmHg
	7	4mA Pressure Unit	Unsigned16	N	2	RW	1157 - mmHg 1133 - kPa 1136 - hPa 1138 - mbar 1141 - psi	1136 - hPa Valid when Proc Pressure Source is Local Ain
	8	4mA Pressure	Float	N	4	RW		0 hPa
	9	20mA Pressure Unit	Unsigned16	N	2	RW	1157 - mmHg 1133 - kPa 1136 - hPa 1138 - mbar 1141 - psi	1136 - hPa Valid when Proc Pressure Source is Local Ain
	10	20mA Pressure	Float	N	4	RW		2000 hPa
	11	Salinity	Float	N	4	RW		0 g/Kg
	12	Humidity	Float	N	4	RW	0 – 100%	100%
	13	Meas_Polarization	Float	N	4	RW	-1260 to 1260mV	Depend on sensor
	14	Cal_Polarization	Float	N	4	RW	-1260 to 1260mV	Depend on sensor
	15	LED Mode	Unsigned8	N	1	RW	0 - OFF 1 - ON(DEFAULT) 2 - AUTO	Optical DO only
	16	Toff	Float	N	4	RW	-10 to 60 ° C	40 ° C
	17	Sampling Rate	Unsigned8	N	1	RW	1to 60s	10s
	18	Process Cal Mode	Unsigned8	N	1	RW	1 - Scaling(DEFAULT) 0 - Calibration	
	19	Raw Current	Float	D	4	R		For O2 amperometric sensor only
	20	Raw Phase	Float	D	4	R		For O2 Optical sensor only
	21	Raw Ain Value	Float	D	4	R		
19	<b>Cond Parameters</b>							
	1	PV compensation	Unsigned8	N	1	RW	0 - Standard(DEFAULT) 1 - Lin25°C 2 - Lin20°C 3 - Light 84 4 - Std 75@C 5 - Glycol.5 6 - Glycol1 7 - Cation 8 - Alcohol 9 - Ammonia 10 - None	
	2	SV compensation	Unsigned8	N	1	RW	Same as PV compensation	
	3	TV compensation	Unsigned8	N	1	RW	Same as PV compensation	
	4	QV compensation	Unsigned8	N	1	RW	Same as PV compensation	

	5	PV Linear value	Float	N	4	RW	0 – 99.99 %/°C	2%/°C ; Valid when PV compensation is Lin25°C or Lin20 °C
	6	SV Linear value	Float	N	4	RW	Same as PV Linear value	
	7	TV Linear value	Float	N	4	RW	Same as PV Linear value	
	8	QV Linear value	Float	N	4	RW	Same as PV Linear value	
	9	Cal compensation	Unsigned8	S	1	RW	Same as PV compensation	
	10	Cal Linear value	Float	S	4	RW	0 – 99.99 %/°C	2%/°C ; Valid when Cal compensation is Lin25°C or Lin20 °C
	11	Raw resistance	Float	D	4	R		
<b>20</b>	<b>ISM Information</b>							
	1	Sensor_Name	VisString	S	14	R		
	2	Sensor_PN	VisString	S	8	R		
	3	Sensor_SN	VisString	S	14	R		
	4	Sensor_FW	VisString	S	6	R		
	5	Sensor_HW	VisString	S	6	R		
	6	ISM Enable_Flag	OctString	S	4	R	bit1:CIP Enable Flag bit2:SIP Enable Flag bit3:AutoClave Enable Flag bit4:TTM Enable Flag bit5:ACT Enable Flag bit6:DLI Enable Flag  bit7:CIP Reset Enable Flag bit8:SIP Reset Enable Flag bit9:AutoClave Reset Enable Flag bit10:TTM Reset Enable Flag bit11:ACT Reset Enable Flag bit12:DLI Reset Enable Flag bit13:pH Stress Enable Flag bit14:Operation day Enable Flag bit15:Max Temp Enable Flag bit16:Max.Temp Date Enable Flag	
<b>21</b>	<b>ISM Monitor</b>							
	1	Operationg_days	Float	D	4	R		
	2	Max_Temperture	Float	D	4	R		
	3	Max_Temp Date	DATE	D	7	R		
	4	TTM with day	Unsigned16	D	2	R		
	5	TTM with %	Unsigned16	D	2	R		
	6	ACT with day	Unsigned16	D	2	R		
	7	ACT with %	Unsigned16	D	2	R		

	8	DLI with day	Unsigned16	D	2	R		
	9	DLI with %	Unsigned16	D	2	R		
	10	CIP_Counter	Unsigned16	D	2	R		
	11	SIP_Counter	Unsigned16	D	2	R		
	12	AutoClave	Unsigned16	D	2	R		
<b>22</b>	<b>ISM Setup</b>							
	1	CIP temperature val	Float	N	4	RW	30 to 100 ° C	55° C
	2	CIP temperature unit	Unsigned16	N	2	RW	1001 - degC 1281 - degF	
	3	CIP limit	Unsigned16	N	2	RW	0 - 254	
	4	SIP temperature val	Float	N	4	RW	30 to 100 ° C	115° C
	5	SIP temperature unit	Unsigned16	N	2	RW	1001 - degC 1281 - degF	
	6	SIP limit	Unsigned16	N	2	RW	0 - 254	
	7	AutoClave Limit	Unsigned16	N	2	RW	0 - 254	0
	8	TTM Limit	Unsigned16	N	2	RW	pH:0 – 400 day others:0 – 10200 day	0
	9	ACT Limit	Unsigned16	N	2	RW	CO2 Hi:0 – 175 day Others:0 – 170 day	0
	10	pH stress adjust	Unsigned8	N	1	RW	0 - Low 1 - Medium 2 - High	1
	11	Reset Cycle counter	Unsigned16	S	2	RW	0 - Reset TTM 1 - Reset CIP 2 - Reset SIP 3 - Reset AutoClave 4 - Reset DLI 5 - Reset SAN Cycles 255 - Uninitialized	255
	12	Type Change	Unsigned8	N	1	RW	0 - Sensor Type Change 1 - Model Change 2 - Autoclave Change	
	13	ISM Status change	Unsigned8	S	1	W	0 - Yes 1 - No(DEFAULT)	
<b>23</b>	<b>Actural Calibration Data</b>							
	1	Last Cal.Date	Date	S	7	R		
	2	Enable flag	OctString	S	2	R	Bit1:mV Cal Flag Bit2:RTD Cal Flag	
	3	Offset Unit1 Code	USIGN16	S	2	R		
	4	Offset Unit2 Code	USIGN16	S	2	R		
	5	Slope Unit1 Code	USIGN16	S	2	R		
	6	Slope Unit2 Code	USIGN16	S	2	R		
	7	ACT Offset 1	Float	S	4	R		

	8	ACT Offset 2	Float	S	4	R		
	9	ACT Slope 1	Float	S	4	R		
	10	ACT Slope 2	Float	S	4	R		
	11	mV offset	Float	S	4	R		
	12	PT RTD Slope	Float	S	4	R		
	13	PT RTD Offset	Float	S	4	R		
	14	NTC22K Offset	Float	S	4	R		
<b>23</b>	<b>ISM Calibration History</b>							
	1	Fact Cal.Date	Date	S	7	R		
	2	Fact Offset 1	Float	S	4	R		
	3	Fact Offset 2	Float	S	4	R		
	4	Fact Slope 1	Float	S	4	R		
	5	Fact Slope 2	Float	S	4	R		
	6	History Enable	OctString	S	2	R		
	7	1.adj Cal.Date	Date	S	7	R		
	8	1.adj Offset 1	Float	S	4	R		
	9	1.adj Offset 2	Float	S	4	R		
	10	1.adj Slope 1	Float	S	4	R		
	11	1.adj Slope 2	Float	S	4	R		
	12	CAL1 Cal.Date	Date	S	7	R		
	13	CAL1 Offset 1	Float	S	4	R		
	14	CAL1 Offset 2	Float	S	4	R		
	15	CAL1 Slope 1	Float	S	4	R		
	16	CAL1 Slope 2	Float	S	4	R		
	17	CAL2 Cal.Date	Date	S	7	R		
	18	CAL2 Offset 1	Float	S	4	R		
	19	CAL2 Offset 2	Float	S	4	R		
	20	CAL2 Slope 1	Float	S	4	R		
	21	CAL2 Slope 2	Float	S	4	R		
	22	CAL3 Cal.Date	Date	S	7	R		
	23	CAL3 Offset 1	Float	S	4	R		
	24	CAL3 Offset 2	Float	S	4	R		
	25	CAL3 Slope 1	Float	S	4	R		
	26	CAL3 Slope 2	Float	S	4	R		
<b>24</b>	<b>Transmitter Info</b>							

	1	Transmitter name	VisString	S	20	R		
	2	Part number	VisString	S	8	R		
	3	Model name	VisString	S	10	R		
	4	Model ID	USIGN16	S	2	R		
	5	Series number	VisString	S	16	R		
	6	Main board firmware	VisString	S	8	R		
	7	Main board hardware	USIGN16	S	2	R		
	8	Slave board firmware	VisString	S	8	R		
	9	Slave board hardware	USIGN16	S	2	R		
	10	Bus app version	USIGN8	S	1	R		
	11	Bus app revision	USIGN8	S	1	R		
	12	Protocol	USIGN8	S	1	R		