

ONSENSA FTX-600/300-PWR+,LUX+,XFMR+ Series Modbus Protocol

RAM Memory Address Table

HEX	DEC	Description	Decimal Values		Hex Values		R/W	Default (HEX)	Example
			Min	Max	Min	Max			
Ch A. Values									
1000	4096	Ch A. Temperature (H)	0	65535	0	FFFF	R	0000	0x0169=(361-273)=88°C (H)
1001	4097	Ch A. Temperature (L)	0	65535	0	FFFF	R	0000	0x1999 = (6553/65535)=0.1°C (L)
1002	4098	Ch A. Time Decay (H)	0	65535	0	FFFF	R	0000	0x1538=5432μs (H)
1003	4099	Ch A. Time Decay (L)	0	65535	0	FFFF	R	0000	0xADCC=(44492/65535)=0.6789μs (L)
1004	4100	Ch A. Light Level	0	4000	0	FA0	R	0000	
1005	4101	Ch A. LED Current	0	4000	0	FA0	R	0000	
1006	4102	Reserved for future	0	0	0	0	R	0000	
1007	4103	Ch A. Status Indication	0	8	0	0008	R	0000	See Config Tables
Ch D. Values									
1008	4104	Ch D. Temperature (H)	0	65535	0	FFFF	R	0000	0x0169=(361-273)=88°C (H)
1009	4105	Ch D. Temperature (L)	0	65535	0	FFFF	R	0000	0x1999 = (6553/65535)=0.1°C (L)
100A	4106	Ch D. Time Decay (H)	0	65535	0	FFFF	R	0000	0x1538=5432μs (H)
100B	4107	Ch D. Time Decay (L)	0	65535	0	FFFF	R	0000	0xADCC=(44492/65535)=0.6789μs (L)
100C	4108	Ch D. Max Light Level	0	65535	0	FFFF	R	0000	
100D	4109	Ch D. LED Current	0	255	0	00FF	R	0000	
100E	4110	Reserved for future	0	255	0	00FF	R	0000	
100F	4111	Ch D. Status Indication	0	8	0	0008	R	0000	See Config Tables
Ch B. Values									
1010	4112	Ch B. Temperature (H)	0	65535	0	FFFF	R	0000	0x0169=(361-273)=88°C (H)
1011	4113	Ch B. Temperature (L)	0	65535	0	FFFF	R	0000	0x1999 = (6553/65535)=0.1°C (L)
1012	4114	Ch B. Time Decay (H)	0	65535	0	FFFF	R	0000	0x1538=5432μs (H)
1013	4115	Ch B. Time Decay (L)	0	65535	0	FFFF	R	0000	0xADCC=(44492/65535)=0.6789μs (L)
1014	4116	Ch B. Light Level	0	4000	0	FA0	R	0000	
1015	4117	Ch B. LED Current	0	4000	0	FA0	R	0000	
1016	4118	Reserved for future	0	0	0	0	R	0000	
1017	4119	Ch B. Status Indication	0	8	0	0008	R	0000	See Config Tables
Ch E. Values									
1018	4120	Ch E. Temperature (H)	0	65535	0	FFFF	R	0000	0x0169=(361-273)=88°C (H)
1019	4121	Ch E. Temperature (L)	0	65535	0	FFFF	R	0000	0x1999 = (6553/65535)=0.1°C (L)
101A	4122	Ch E. Time Decay (H)	0	65535	0	FFFF	R	0000	0x1538=5432μs (H)
101B	4123	Ch E. Time Decay (L)	0	65535	0	FFFF	R	0000	0xADCC=(44492/65535)=0.6789μs (L)
101C	4124	Ch E. Max Light Level	0	65535	0	FFFF	R	0000	

ONSENSA FTX-600/300-PWR+,LUX+,XFMR+ Series Modbus Protocol

RAM Memory Address Table

HEX	DEC	Description	Decimal Values		Hex Values		R/W	Default (HEX)	Example
			Min	Max	Min	Max			
100x Temperature in °C, valid reading? (Format: xxx.xn)									
0400	1024	Ch A (1)	-32768	32767	0	FFFF	R	32767	Max Range: -273.15 to +327.66, No probe = 32767
0401	1025	Ch B (2)	-32768	32767	0	FFFF	R	32767	Std Range: -50.00 to +225.00, No Probe 32767
0402	1026	Ch C (3)	-32768	32767	0	FFFF	R	32767	Last Digit=xxx.x0, (even) means valid temp reading
0403	1027	Ch D (4)	-32768	32767	0	FFFF	R	32767	Last Digit=xxx.x1, (odd) means convergence error
0404	1028	Ch E (5)	-32768	32767	0	FFFF	R	32767	Examples:
0405	1029	Ch F (6)	-32768	32767	0	FFFF	R	32767	HexDecTemp (°C)Comment
0406	1030	Ch G (7)	-32768	32767	0	FFFF	R	32767	0x303412340123.4Valid reading
0407	1031	Ch H (8)	-32768	32767	0	FFFF	R	32767	0xF2A3-3421-34.2Converging
0408	1032	Ch I (9)	-32768	32767	0	FFFF	R	32767	0x7FFF32767327.6Probe Error
0409	1033	Ch J (10)	-32768	32767	0	FFFF	R	32767	
040A	1034	Ch K (11)	-32768	32767	0	FFFF	R	32767	
040B	1035	Ch L (12)	-32768	32767	0	FFFF	R	32767	
...	...	...							
100x LED Power as %, status number (Format: xxx.xn)									
0464	1124	Ch A (1)	-32768	32767	0	FFFF	R	100.1	Max Range: 0.01 to 100.09, No Probe=100.02
0465	1125	Ch B (2)	-32768	32767	0	FFFF	R	100.1	Examples:
0466	1126	Ch C (3)	-32768	32767	0	FFFF	R	100.1	HexDecPwr %StatusComment
0467	1127	Ch D (4)	-32768	32767	0	FFFF	R	100.1	0x04E3125112.51LED Current
0468	1128	Ch E (5)	-32768	32767	0	FFFF	R	100.1	0x271210002100.02No Probe
0469	1129	Ch F (6)	-32768	32767	0	FFFF	R	100.1	0x271310003100.03Max LED Current
046A	1130	Ch G (7)	-32768	32767	0	FFFF	R	100.1	Formula to convert DAC counts to % or mA
046B	1131	Ch H (8)	-32768	32767	0	FFFF	R	100.1	DAC%mA
046C	1132	Ch I (9)	-32768	32767	0	FFFF	R	100.1	2510.3125
046D	1133	Ch J (10)	-32768	32767	0	FFFF	R	100.1	10031.25
046E	1134	Ch K (11)	-32768	32767	0	FFFF	R	100.1	400105
046F	1135	Ch L (12)	-32768	32767	0	FFFF	R	100.1	8002010
0470	1136	Ch M (13)	-32768	32767	0	FFFF	R	100.1	16004020
0471	1137	Ch N (14)	-32768	32767	0	FFFF	R	100.1	20005025
0472	1138	Ch O (15)	-32768	32767	0	FFFF	R	100.1	400010050
0473	1139	Ch P (16)	-32768	32767	0	FFFF	R	100.1	To extend LED life operate below 10% LED Power at time of installation
0474	1140	Ch Q (17)	-32768	32767	0	FFFF	R	100.1	
0475	1141	Ch R (18)	-32768	32767	0	FFFF	R	100.1	
...	...	...							

Probe Error Alarms

04C8	1224	Ch 1-16	0	65535	0	FFFF	R	0	BIT0 = ChA, Bit1 = ChB, ...
04C9	1225	Ch 17-32							
04CA	1226	Ch 33-48							
...	...	...							

Analog Range Alarms

04D2	1234	Ch 1-16	0	65535	0	FFFF	R	0	BIT0 = ChA, Bit1 = ChB, ...
04D3	1235	Ch 17-32							
04D4	1236	Ch 33-48							
...	...	...							

Warning Alarms

04DC	1244	Ch 1-16	0	65535	0	FFFF	R	0	BIT0 = ChA, Bit1 = ChB, ...
04DD	1245	Ch 17-32							
04DE	1246	Ch 33-48							
...	...	...							

Critical Alarms

04E6	1254	Ch 1-16	0	65535	0	FFFF	R	0	BIT0 = ChA, Bit1 = ChB, ...
04E7	1255	Ch 17-32							
04E8	1256	Ch 33-48							
...	...	...							

FLASH EEPROM Modbus Address Table

(Values in this table are retained when power is cycled to the device)

v3.11

HEX	DEC	Description	Min	Max	Min	Max	R/W	Default (HEX)	Example
Customer Security Code									
0000	0	Customer Access Code	0	65535	0	FFFF	R/W	0	Customer Pwd=0, Factory Reset FFFF
Device Information (Factory Set)									
0001	1	Reserved	0	65535	0	FFFF	R	0	Undocumented
0002	2	Serial number (H)	0	65535	0	FFFF	R	0	42100188=0x0282 (H)
0003	3	Serial number (L)	0	65535	0	FFFF	R	0	42100188=0x65DC (L)
0004	4	Firmware Part Number	0	65535	0	FFFF	R	1	SCC-1234A=0x04D2
0005	5	Firmware Version	0	255.255	0	FF.FF	R	255	V1.12=0x010C
0006	6	Enabled Channels	0	63	0	3F	R	707	ABC=0000 0111=0x007, See Config Tables
0007	7	Reserved	-32768	32768	-8000	8000	R	8000	Undocumented
0008	8	Reserved	-32768	32768	-8000	8000	R	8000	Undocumented
0009	9	Reserved	-32768	32768	-8000	8000	R	8000	Undocumented
Device Configuration Settings									
000A	0010	Modbus Device ID	1	247	1	00F7	R/W	00F7	Default Modbus address is 247
000B	0011	USB Baud-Rate (8N1)	0	7.1	0	07.01	R/W	701	115200=0x0701, See Config Tables
000C	0012	RS485 Baud-Rate (8N1)	0	7.1	0	07.01	R/W	301	9600=0x0301, See Config Tables
000D	0013	Configuration Switches	0	65535	0	FFFF	R/W	0	See Config Tables
000E	0014	Convergence Filter	0	65535	0	FFFF	R/W	000A	Do Not Change
000F	0015	LED Pulse Width	0	65535	0	FFFF	R/W	20	Do Not Change
0010	0016	Acquisition Delay	0	65535	0	FFFF	R/W	000A	Do Not Change
0011	0017	Target Light Level	0	65535	0	FFFF	R/W	0BB8	Do Not Change
0012	0018	Reserved	0	65535	0	FFFF	R/W	64	Do Not Change
0013	0019	Reserved	0	65535	0	FFFF	R/W	0	Do Not Change
Channel Settings									
0014	0020	Ch A. Zero	0	65535	0	FFFF	R/W	00DF	-50°C=(273K-50K)=0x00DF
0015	0021	Ch A. Span	0	65535	0	FFFF	R/W	FA	250°C=0x00FA
0016	0022	Ch A. Offset	-32768	32768	-8000	8000	R/W	8000	+0.150°C=(32768+150)=0x8096
0017	0023	Ch A. Probe Alarm	0	2	0	0002	R/W	2	High=0x0002, Low=0x0001, Off=0x0000
0018	0024	Ch A. Range Alarm	0	2	0	0002	R/W	2	High=0x0002, Low=0x0001, Off=0x0000
0019	0025	Ch A. Averaging Filter	0	65535	0	FFFF	R/W	03E8	1000ms=0x03E8
001A	0026	Ch A. Max LED Current	0	4000	0	FA0	R/W	FA0	4000 DAC Counts is approximately 50mA
001B	0027	Ch A. Signal Gain	0	1	0	1	R/W	0	Low Gain=0x000, High Gain +6dB=0x0001
001C	0028	Ch B. Zero	0	65535	0	FFFF	R/W	00DF	-50°C=(273K-50K)=0x00DF
001D	0029	Ch B. Span	0	65535	0	FFFF	R/W	FA	250°C=0x00FA
001E	0030	Ch B. Offset	-32768	32768	-8000	8000	R/W	8000	+0.150°C=(32768+150)=0x8096
001F	0031	Ch B. Probe Alarm	0	2	0	0002	R/W	2	High=0x0002, Low=0x0001, Off=0x0000
0020	0032	Ch B. Range Alarm	0	2	0	0002	R/W	2	High=0x0002, Low=0x0001, Off=0x0000
0021	0033	Ch B. Averaging Filter	0	65535	0	FFFF	R/W	03E8	1000ms=0x03E8
0022	0034	Ch B. Max LED Current	0	4000	0	FA0	R/W	FA0	Do Not Change
0023	0035	Ch B. Signal Gain	0	1	0	1	R/W	0	Low Gain=0x000, High Gain +6dB=0x0001
0024	0036	Ch C. Zero	0	65535	0	FFFF	R/W	00DF	-50°C=(273K-50K)=0x00DF
0025	0037	Ch C. Span	0	65535	0	FFFF	R/W	FA	250°C=0x00FA
0026	0038	Ch C. Offset	-32768	32768	-8000	8000	R/W	8000	+0.150°C=(32768+150)=0x8096
0027	0039	Ch C. Probe Alarm	0	2	0	0002	R/W	2	High=0x0002, Low=0x0001, Off=0x0000
0028	0040	Ch C. Range Alarm	0	2	0	0002	R/W	2	High=0x0002, Low=0x0001, Off=0x0000
0029	0041	Ch C. Averaging Filter	0	65535	0	FFFF	R/W	03E8	1000ms=0x03E8
002A	0042	Ch C. Max LED Current	0	4000	0	FA0	R/W	FA0	Do Not Change
002B	0043	Ch C. Signal Gain	0	1	0	1	R/W	0	Low Gain=0x000, High Gain +6dB=0x0001
Reserved									
002C	0044	Reserved	0	65535	0	FFFF	R/W	0	Do Not Change
002D	0045	Reserved	0	65535	0	FFFF	R/W	0	Do Not Change
002E	0046	Reserved	0	65535	0	FFFF	R/W	0	Do Not Change
002F	0047	Reserved	0	65535	0	FFFF	R/W	0	Do Not Change

0030	0048	Reserved	0	65535	0	FFFF	R/W	0	Do Not Change
0031	0049	Reserved	0	65535	0	FFFF	R/W	0	Do Not Change
Calibration Table: Ch A. Temperature									
0032	0050	Ch A. Temp 1 (H)	0	65535	0	FFFF	R/W	0	88.1°C=(273+88)=0x0169 (H)
0033	0051	Ch A. Temp 1 (L)	0	65535	0	FFFF	R/W	0	88.1°C=(0.1*65535)=0x1999 (L)
...	...	...	...	...	...	...	...	...	
006C	0108	Ch A. Temp 30 (H)	0	65535	0	FFFF	R/W	0	
006D	0109	Ch A. Temp 30 (L)	0	65535	0	FFFF	R/W	0	
Calibration Table: Ch A. Time Decay									
006E	0110	Ch A. Decay 1 (H)	0	65535	0	FFFF	R/W	0	5432.6789μs=0x1538 (H)
006F	0111	Ch A. Decay 1 (L)	0	65535	0	FFFF	R/W	0	5432.6789μs=(65535*.6789)=0xADCC (L)
...	...	...	...	...	...	...	...	...	
00A8	0168	Ch A. Decay 30 (H)	0	65535	0	FFFF	R/W	0	
00A9	0169	Ch A. Decay 30 (L)	0	65535	0	FFFF	R/W	0	
Calibration Table: Ch B. Temperature									
00AA	0170	Ch B. Temp 1 (H)	0	65535	0	FFFF	R/W	0	
00AB	0171	Ch B. Temp 1 (L)	0	65535	0	FFFF	R/W	0	
...	...	...	...	...	...	...	...	...	
00E4	0228	Ch B. Temp 30 (H)	0	65535	0	FFFF	R/W	0	
00E5	0229	Ch B. Temp 30 (L)	0	65535	0	FFFF	R/W	0	
Calibration Table: Ch B. Time Decay									
00E6	0230	Ch B. Decay 1 (H)	0	65535	0	FFFF	R/W	0	
00E7	0231	Ch B. Decay 1 (L)	0	65535	0	FFFF	R/W	0	
...	...	...	...	...	...	...	...	...	
0120	0288	Ch B. Decay 30 (H)	0	65535	0	FFFF	R/W	0	
0121	0289	Ch B. Decay 30 (L)	0	65535	0	FFFF	R/W	0	
Calibration Table: Ch C. Temperature									
0122	0290	Ch C. Temp 1 (H)	0	65535	0	FFFF	R/W	0	
0123	0291	Ch C. Temp 1 (L)	0	65535	0	FFFF	R/W	0	
...	...	...	...	...	...	...	...	...	
015C	0348	Ch C. Temp 30 (H)	0	65535	0	FFFF	R/W	0	
015D	0349	Ch C. Temp 30 (L)	0	65535	0	FFFF	R/W	0	
Calibration Table: Ch C. Time Decay									
015E	0350	Ch C. Decay 1 (H)	0	65535	0	FFFF	R/W	0	
015F	0351	Ch C. Decay 1 (L)	0	65535	0	FFFF	R/W	0	
...	...	...	...	...	...	...	...	...	
0198	0408	Ch C. Decay 30 (H)	0	65535	0	FFFF	R/W	0	
0199	0409	Ch C. Decay 30 (L)	0	65535	0	FFFF	R/W	0	

Specific Configuration Tables

Flash 6 Enabled Channels

	Ch A	Ch B	Ch C	Ch D	Ch E	Ch F
Low Byte	Channel Enable					
0000 0000						
0000 0001	x					
0000 0010		x				
0000 0100			x			
0000 1000				x		
0001 0000					x	
0010 0000						x
0000 0011	x	x				
0000 0111	x	x	x			
0000 1111	x	x	x	x		
0001 1111	x	x	x	x	x	
0011 1111	x	x	x	x	x	x

Channels	Hex	Dec
None	0	0
A	1	1
B	2	2
C	3	4
D	8	8
E	10	16
F	20	32
AB	3	3
ABC	7	7
ABCD	F	15
ABCDE	1F	31
ABCDEF	3F	63

Flash 11, 12 Baud-Rate, Parity, Stop Bits

Baud Rate

High	Rate
00	1200
01	2400
02	4800
03	9600
04	19200
05	38400
06	57600
07	115200
08	reserved
09	reserved
10	reserved

Parity

Low (H)	Parity
0	None

Stop Bits

Low (L)	Bits
1	1

USB Factory Default: 0701 (115200,None,1)
 RS485 Factory Default: 0301 (9600,None,1)

Flash 13 Special Device Configurations

Low Byte	Configuration Mode
0000 0000	Default, normal operation
0000 0001	Reserved
0000 0010	Reserved
0000 0100	Reserved
0000 1000	Reserved
0001 0000	4-20mA output signal set to maximum temperature or alarm condition seen on any channel

RAM 4103, 4119, 4135 Channel Status Table

LED Color	State	Description	Status
Green	Solid	Probe connected, no fault conditions	1
	Blinking	Probe disconnected, Probe recovery mode	2
Orange	Solid	Probe connected, Max LED current	3
	Blinking	Probe connected, low light level	4
Red	Solid	Subtle convergence problem or EEPROM Write	7
	Blinking	No signal, possible LED Failure	6
None	Off	No Power to the Transmitter	-

Not converged status bit, add 128 to above status

RAM 4145, 4146 Analog Alarm States

4145 High	Ch A	Ch B	Ch C
4146 High	Ch D	Ch E	Ch F
Analog Probe Alarm			
0b000			
0b001	x		
0b010		x	
0b011	x	x	
0b100			x
0b101	x		x
0b110		x	x
0b111	x	x	x

4145 Low	Ch A	Ch B	Ch C
4146 Low	Ch D	Ch E	Ch F
Analog Range Alarm			
0b000			
0b001	x		
0b010		x	
0b011	x	x	
0b100			x
0b101	x		x
0b110		x	x
0b111	x	x	x

x = alarm condition true

Modbus Functions Supported

Standard Functions

Example: (0x03) Read Multiple Registers

	ID	Function	Addr.H	Addr.L	# Bytes.H	# Bytes.L	CRC.H	CRC.L
Master Send	0xF7	0x03	0x00	0x02	0x00	0x02	0x??	0x??

	ID	Function	# Bytes	Value.H	Value.L	Value.H	Value.L	CRC.H	CRC.L
Slave Response	0xF7	0x03	0x04	0x11	0x11	0x22	0x22	0x??	0x??

	ID	Function	Addr.H	Addr.L	Value.H	Value.L	CRC.H	CRC.L
Slave Response	0xF7	0x06	0x00	0x02	0xFF	0xFF	0x??	0x??

(Normal Response is echo of query)

Example: (0x10) Write Multiple Registers

	ID	Function	Addr.H	Addr.L	# Regs.H	# Regs.L	# Bytes	Value.H	Value.L	Value.H	Value.L	CRC.H	CRC.L
Master Send	0xF7	0x10	0x00	0x02	0x00	0x02	0x04	0x11	0x11	0x22	0x22	0x??	0x??

	ID	Function	Addr.H	Addr.L	# Regs.H	# Regs.L	CRC.H	CRC.L
Slave Response	0xF7	0x10	0x00	0x02	0x00	0x02	0x??	0x??

Custom Function

Perform a Custom Password Function by sending the function code 100 (0x64) followed by the 2-byte sub function command to specify which password function to perform.

Available sub functions:

0x0001	Set "customer unlock" bit enabled
0x0003	Change customer security code

To read or write to certain Modbus registers, the "customer unlock" bit needs to be enabled first.

Once enabled, this bit is reset only after power cycling.

Example: (0x64) Customer Password

	ID	Function	Sub Func.H	Sub Func.L	Pwd.H	Pwd.L	Blank	Blank	CRC.H	CRC.L
Master Send	0xF7	0x64	0x00	0x01	0x00	0x00	0x00	0x00	0x??	0x??

	ID	Function	Sub Func.H	Sub Func.L	CRC.H	CRC.L
Slave Response	0xF7	0x64	0x00	0x01	0x??	0x??

Example: (0x64) Change Password

	ID	Function	Sub Func.H	Sub Func.L	Old Pwd.H	Old Pwd.L	New Pwd.H	New Pwd.L	CRC.H	CRC.L
Master Send	0xF7	0x64	0x00	0x03	0x??	0x??	0x??	0x??	0x??	0x??

	ID	Function	Sub Func.H	Sub Func.L	CRC.H	CRC.L
Slave Response	0xF7	0x64	0x00	0x03	0x??	0x??

Note: To do Factory Reset,
Send 0xFFFF as both Old and New Password

Exceptions

	ID	Function	CODE	CRC.H	CRC.L
illegal Function	0xF7	0x90	0x01	0x??	0x??
illegal Data Address	0xF7	0x90	0x02	0x??	0x??
illegal Data Value	0xF7	0x90	0x03	0x??	0x??
Custom Error - Pwd R	0xF7	0xE4	0x0E	0x??	0x??

Note: Add 0x80 to function sent. Eg. 0x64 + 0x80 = 0xE4
Means requested function is not supported
Means device is not "Unlocked", or wrong memory address
Means structure of command has wrong # of bytes
Means wrong password sent

Permissions

Modbus Address Permission Table					
	HEX	DEC	Full Security	Cust. Security Code *	
EEPROM AREA	0000 - 0001	0	-	R/W	Customer Security Code, only accessible by custom function 0x64
EEPROM AREA	0002 - 0009	1-9	R	R	Device Information
EEPROM AREA	000A - 0031	10-49	R	R/W	Device Configuration and Channel Settings
EEPROM AREA	0032 - 0199	50-409	-	R/W	Calibration Tables
RAM AREA	1000 - 103F	4096 - 4159	R	R	Device Output
* Default Customer Security Code = 0000					

Supported Device ID's

Modbus ID

1-247	Note that default factory device ID=247
0	Broadcast ID - Message read by all devices on RS-485 Bus, but no responses sent - user can reset the system (Function 0x64 is supported) - user can write to registers (Function 0x16 is supported) - user cannot read any registers (Function 0x03 is not supported) - no response will be sent back to the user in any case mentioned above