

OSX – Open-SDI12-Blue Bluetooth®

Version Micropilot FMR20 Radar Distance Sensor from Endress + Hauser, Type 390

1 Quick setup



Micropilot FMR20 with Modbus



Modbus to SDI-12 / Bluetooth LE Converter (Version B with 2 internal CR123A Batteries)

The **OSX FMR20_Radar_Distance** is a SDI12 Interface to the Radar distance Sensor FMR20 from Endress + Hauser. For details refer to the sensor’s data sheet:

https://portal.endress.com/wa001/dla/5001068/3252/000/02/TI01267FDE_0316.pdf

The OSX interface is based on the OSX Type 210 (Universal Modbus Interface), initialised to the FMR20 for “ready to run”:

- “Type 210” Measure command: ‘r200 5000 FFFF’:
 - r: Read Input Registers (Modbus Function 3)
 - 5 Registers from Modbus Register 5000 at Modbus Device with Addr. 200
 - SDI12-Register #0-#4 as Float (5 Registers)

- “Type 210” Units configuration: ‘Lev m db oC Sig Diag’:
 - #0: Level (Precalculated internal value of the FMR20 (Default: mtr.))
 - #1: meter (FMR20 Target distance (mtr))
 - #2: dB (FMR20 Signal level)
 - #3: °C (FMR20 Temperature)
 - #4: Sig (FMR20 Signal Quality)

- #5:Diag (FMR20 Diagnostic No., (not enabled by default))

- Ultra-Low-Power operation of the sensor with 15 secs Warm-Up

The OSX Interface is designed to work from 2.8V – 16V. However often Modbus sensors require at least 5V. Hence the OSX Interface is available in 3 Versions.

Version A: Supply 5V – 16V

Version B: No external Power needed, Supply is via internal Batteries.

This Version also has the advantage that it is always accessible by Bluetooth!

For the FMR20 2 Batteries CR123A are recommended.

This is OK for ca. 6 years standby or ca. 35000 measures.

A blue LED signals a running measure.

For Version B we recommend using SDI12 command 'aM1!' 'aMC1!', this includes the Voltage of the batteries. Replace if below 5V!

Version C: Supply 2.8V – 16V

Firmware Update Info: All Versions share the same Firmware (Type 390).

SDI-12-Cable (core cable ends or optionally with Connector (AKL-169-04 (RIA CONNECT, RM 3.5mm))):

BLACK:	GND
(BROWN:	5V-16V Supply (only Version A!))
BLUE or WHITE:	SDI-12 Signal

The command set is based on standard SDI12 (V1.3) command set. Most important commands:

- aAn! : Change Address from 'a' to 'n'. (a might be always be a '?' as wild card).
- aI! : Identify Node (should identify as 'a13TT_MBO_A_0390_OSXxxxxxxxx')
- aM! : Start measure (also 'aMC!'). This will start the measure. After finishing all measured values are available in an internal cache. Read the data with „D“- command
- aM1! : Start measure (also 'aMC1!'). This will start the measure including Supply Voltage. After finishing all measured values are available in an internal cache. Read the data with „D“- command
- aD0! : This will read the measures from the preceding „M“- command.

Error codes (all values lower than -700.000):

- 700..-755: MODBUS Error Codes (700: Code 0..755: Code:255)
- 1000: Sensor internal error ('No Reply') probably sensor or internal connection broken)
- 10xx: Protocol error or Data corrupt (may water in the sensor or cable).
- others: Displayed as text in BLX.JS or BlueShell

2 The Open-SDI12-Blue platform

OSX Sensors are based on an open platform:

Link: <https://github.com/joembedded/Open-SDI12-Blue>

3 Software

3.1.1 Software to access the sensor

OSX Sensors can be accessed by SDI12 (V1.3) or Bluetooth BLE or SDI12 via Bluetooth.

- BlueShell for PC (Windows 10 / 11)
- BLX.JS (PC (Browsers: Chrome, Edge, Opera, ...) or Android). No APP required!

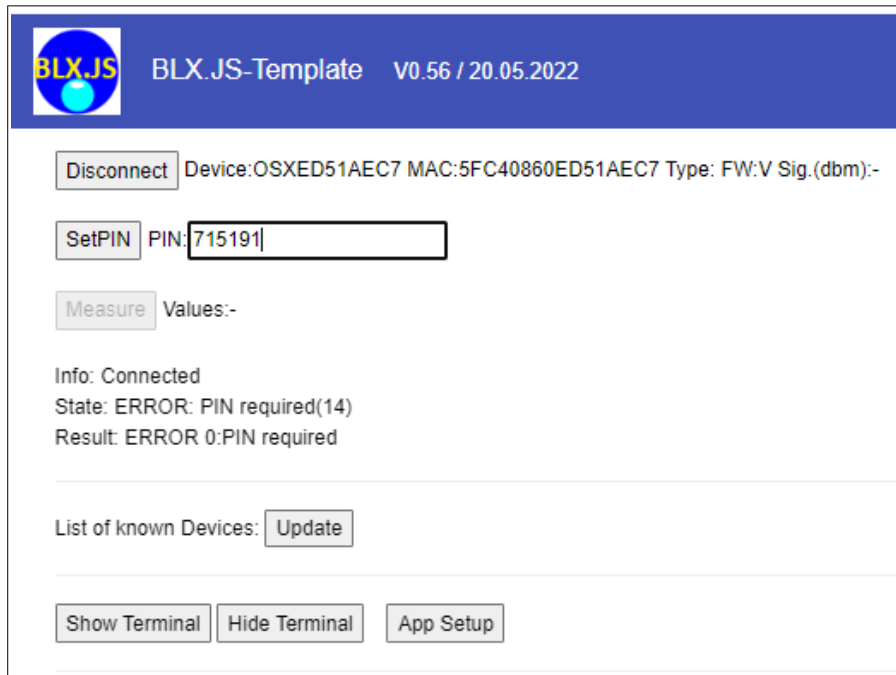
Link: [Download Link BlueShell or BLX.JS](#)

3.1.2 Software for SDI12

- A simple SDI12Term for PC (Windows) (connect SDI12 sensors via RS232)

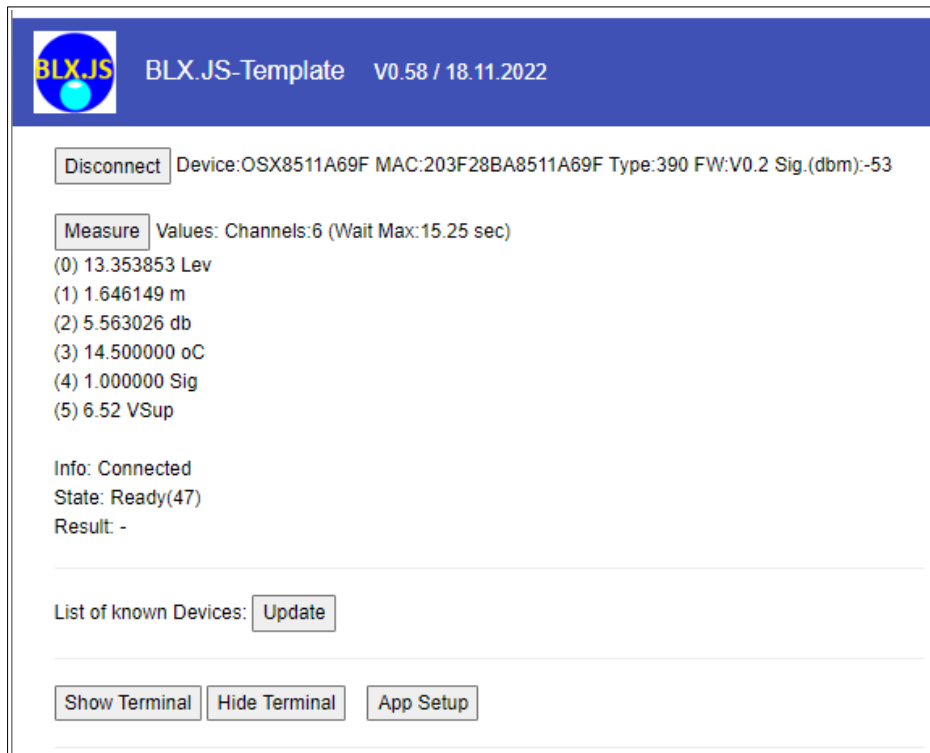
Link: <https://github.com/joembedded/SDI12Term>

4 Sample session BLX.JS



Enter PIN only required once!

The sensors are locked with a 6 digit PIN (Authentication method: Challenge-Response)



Measure

5 Commands

A selection of commands for setup (enter via BLX.JS or BlueShell Terminal)

5.1.1 Commands for this type (Huba713_Ceramic Type 420):

Measure:

- M or MC or M1 or MC1 starts the measure, measure takes < 1 sec (optionally the Warm-Up Time can be changed, see below)
- D replies the values

5.1.2 Standard commands for Open-SDI12-Blue (SDI12 via BLE):

All „SDI12 via BLE“ commands are preceded by ‚z‘:

> z?I!	SDI12 via BLE: Identify
Reply: '013TT_MOB_A_0390_OSX8511A69F<CR><LF>'	
End: 'OK' (Runtime: 229 msec)	
> z?M1!	SDI12: Measure (M1)
Reply: '00166<CR><LF>'	SDI12: 6 Values in 16 secs.
Reply: '0<CR><LF>'	
End: 'OK' (Runtime: 358 msec)	
> z?D0!	SDI12: Values, Part 1
Reply: '0+13.172609+1.827391+10.599263<CR><LF>'	
End: 'OK' (Runtime: 302 msec)	
> z?D1!	SDI12: Values, Part 2
Reply: '0+14.000000+0.000000+6.48<CR><LF>'	SDI12: 6.48 is Battery Voltage
End: 'OK' (Runtime: 302 msec)	
> z?MC!	SDI12: Measure+CRC
Reply: '00165<CR><LF>'	
Reply: '0<CR><LF>'	
End: 'OK' (Runtime: 387 msec)	
> z?D0!	SDI12: ‚@ ‘ is CRC
Reply: '0+13.172612+1.827389+10.599262@C <CR><LF>'	
End: 'OK' (Runtime: 290 msec)	
> z?XDevice!	SDI12: XDevice
Reply: '0M:2299983A7740B474,T:390,V1.0, P:715191!<CR><LF>'	SDI12: Red: Dev.PIN
End: 'OK' (Runtime: 299 msec)	
> z?XFactoryReset!	SDI12: Factors Reset:
Disconnected while Busy('z?XFactoryReset!')	SDI12: New setup
ERROR: Disconnected ('z?XFactoryReset!')	SDI12: required!

5.1.3 Some standard commands for BLX.JS (not available with BlueShell):

(Remark: BLX.JS is our BLE driver written in JavaScript, it could easily be used with other HTML too).

> .a	.a or .audio: „Finder 🎵“
Audio: RSSI: OFF, Term: ON	
> .audio 1 1	Audio & Finder 🎵 ,ON‘
Audio: RSSI: ON, Term: ON	
> .firmware	Secure firmware update
Select new firmware (*.sec)...	

5.1.4 Special commands for Open-SDI12-Blue (SDI12 via BLE):

Sensor setup / scan commands:

Important: our sensors are delivered “ready-2-run” and normally no special setup is required (except e.g. after Factory Reset or if sensor configuration was changed). The following commands are only listed for technical completeness or for changed setup

For details please read the docu of the OSX Type 210 (Universal Modbus Interface)

6 Power Supply

The OSX Sensor works from 2.8V to 16V (see Open-SDI12-Blue documentation).

However often Modbus sensors require at least 5V. Hence the OSX Interface is available in 3 Versions (see 1. Quick Setup):

- Version A: Supply 5V – 16V
- Version B: No external Power needed, Supply is via internal Batteries.
- Version C: Supply 2.8V – 16V

Measure: <10mA for ca. 500 – typically 15000 msec, depending if Sensor is constantly powered.

Operating Temperature: -40°C - +85°C

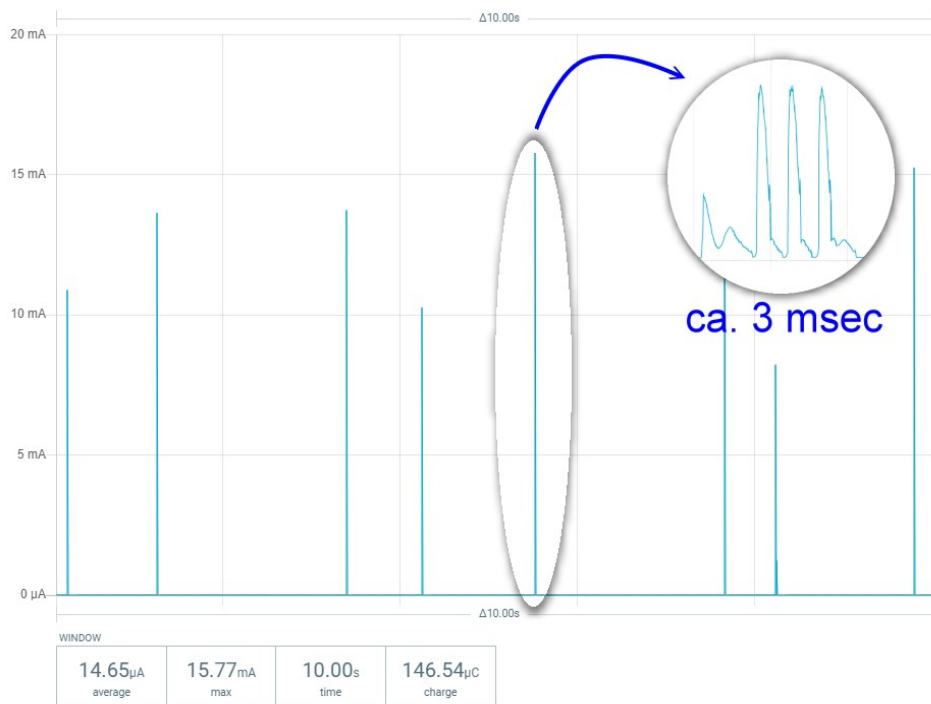
7 Power Profile

7.1.1 Power Up Sequence

The Sensor is ready after ca. 250 msec.

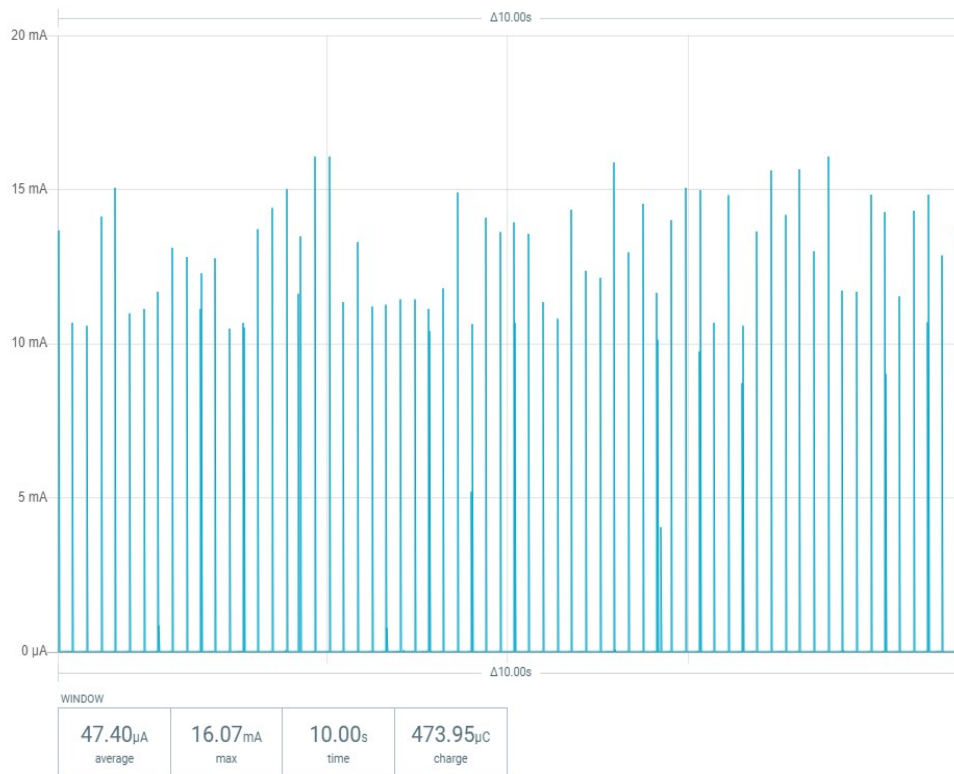
7.1.2 Advertising (in deep sleep)

Average power consumption in deep sleep is <15 μ A @ 5V



Advertising power consumption (one peak zoomed)

7.2 Connected Mode



Connected power consumption

In Connected Mode (active BLE connection) the average power consumption is <math><50 \mu\text{A}</math> @ 4V

8 Compliance (Version: FMR20 Radar Distance)

8.1 Compliance: CE, RoHS



- EN 55022 Emission, class B < 30 dB μ V/m (0.03...1 GHz)
- EN 61000-4-2 Electrostatic discharge 4 kV contact / 8 kV air
- EN 61000-4-3 Irradiated RF 10V/m (0.1...1 GHz)
- EN 61000-4-4 Transients (burst) 4 kV
- EN 301 489-1 V2.1.1 and EN 301 489-17 V3.1.1 EMC
- EN 300 328 V2.1.1 EN 300 330 V2.1.1 Radio Emission
- Bluetooth SIG listed: ID 138612

The sensor OSX – Version FMR20 Radar Distance, Type 390 complies with the essential requirements of Radio Equipment Directive (RED) 2014/53/EU and with the Directive 2011/65/EU (EU RoHS 2) and its amendment Directive (EU) 2015/863 (EU RoHS 3).

Manufacturers:

GeoPrecision GmbH
Am Dickhäuterplatz 8
D-76275 Ettlingen

Terratransfer GmbH
Ottostr. 19a
D-44867 Bochum

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A handwritten signature in black ink, appearing to read 'Jürgen Wickenhäuser', written over a light blue horizontal line.

Jürgen Wickenhäuser (R&D)
