



## FBR-100AN Modbus TCP Activation: Supported CNC Devices and Collectable Information

Application Notes : AN20210901  
silex technology, Inc.



 When it **Absolutely Must** Connect

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## 1. Overview

This document describes what CNC devices are supported and what data can be collected by Modbus TCP Activation for FBR-100AN, a protocol converter for CNC machine tools.

## 2. Modbus TCP Activation Specifications

### [Modbus TCP Activation Specifications]

- FBR-100AN runs in Modbus TCP slave mode.
- FBR-100AN obtains the operation data of a CNC device from the host software or device being the Modbus TCP master.
- A single FBR-100AN connects to one CNC device.
- The CNC device program information, macro variables, and the PMC information can be collected.<sup>1</sup>
- Modbus TCP works in the exclusive mode with FBR-100AN's default MTConnect communication.

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<sup>1</sup> See Chapter 5 "FBR-100AN Modbus TCP Activation Monitoring Data" in this document.

### 3. Supported CNC Devices

FBR-100AN's Modbus TCP Activation has been confirmed compatible with the following CNC devices.

Maker	How to Connect	Model	FBR-100AN Monitoring Data
FANUC	LAN	30i-MODEL A, 30i-MODEL B 31i-MODEL A, 31i-MODEL B 31i-MODEL A5, 31i-MODEL B5 32i-MODEL A, 32i-MODEL B 35i-MODEL B 0i-M/T MODEL F, 0i-M/T MODEL D	See Chapter 5 "FBR-100AN Modbus TCP Activation Monitoring Data" in this document.

Note: Supported CNC devices/equipment and functions vary depending on FBR-100AN and its activation programs (optional).

Main function	Activation				
	Standard	For Brother Industries	For Muratec	OPC UA	Modbus TCP
Supported CNC device	FANUC CNC	Brother Industries CNC	Muratec machines & dedicated system	FANUC CNC	FANUC CNC
RS-232C/DPRNT communications	Supported	N/A	N/A	N/A	N/A
PATLITE AirGRID® Link	Supported	N/A	N/A	N/A	N/A
Host system communication protocol	MTConnect	MTConnect	MTConnect	OPC UA/umati	Modbus TCP

## 4. Use of FBR-100AN Modbus TCP Activation

### 4.1. Enable Modbus TCP Activation

- This activation function is a paid option and must be purchased in addition to the FBR-100AN main unit.
- Refer to the setup guide of FBR-100AN and register the activation key (alphanumeric characters) you purchased.
- Restart FBR-100AN after registering the activation key to enable the Modbus TCP settings.

### 4.2. Modbus TCP Connection Diagram

FBR-100AN serves as a Modbus TCP slave. Use the device together with a Modbus TCP master.

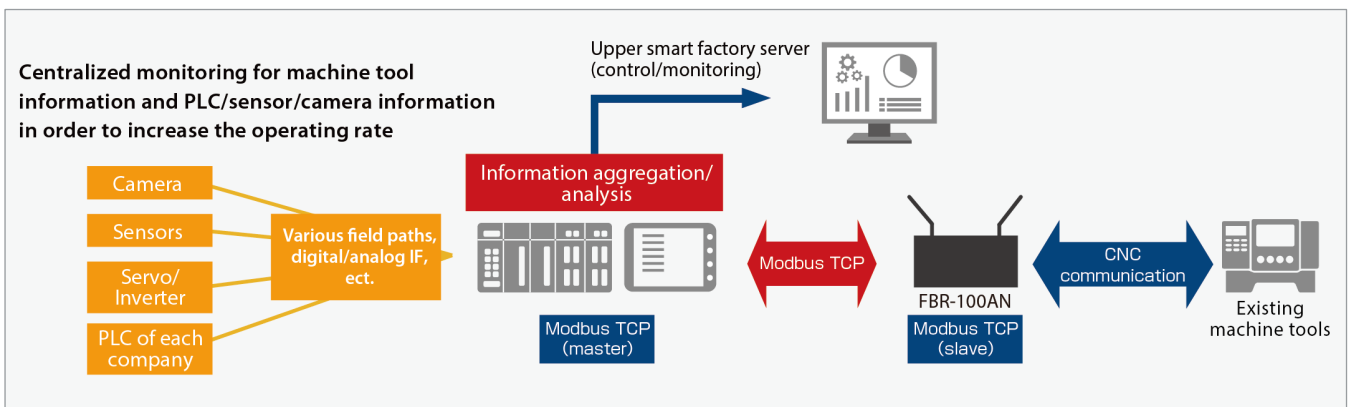
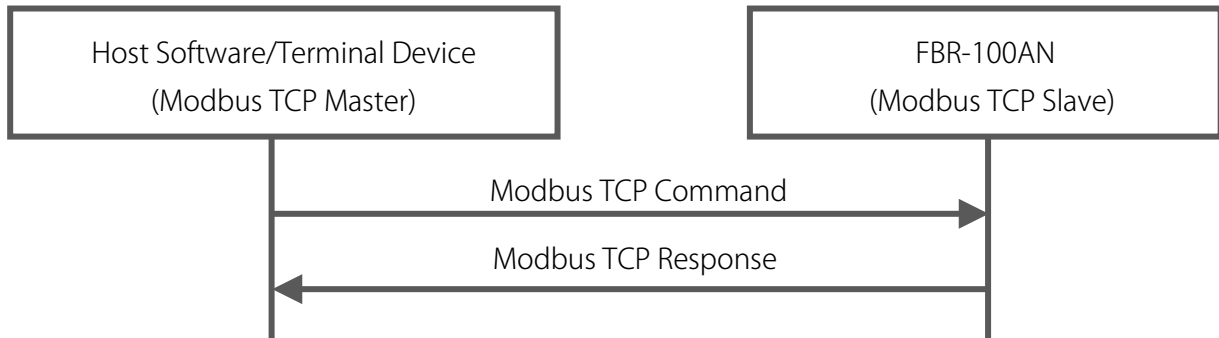


Figure 1 : System Configuration for Modbus TCP

### 4.3. Modbus TCP Communication

The following diagram shows the communication sequence between FBR-100AN's Modbus TCP slave and the host Modbus TCP master.



- A single FBR-100AN, a slave unit in Modbus TCP, can connect to a single Modbus TCP master unit.
- The Modbus TCP master can specify up to 125 words, which is the max data size for read and is compliant with the Modbus specifications.
- The supported command is only the function code 0x04 (read of the input register value). Other function codes including write are not supported.
- The responses are the exception code 0x03 (irregular data) when the size of the read data is more than 125 words, and 0x02 (exception code) for other commands including write.
- ASCII code is used for the character strings. A numeric value is also returned in ASCII code. Only the PMC information is returned in a numeric value.
- The address is set per word (2 bytes), but a character string is set per byte. Big-Endian is used for the byte order.

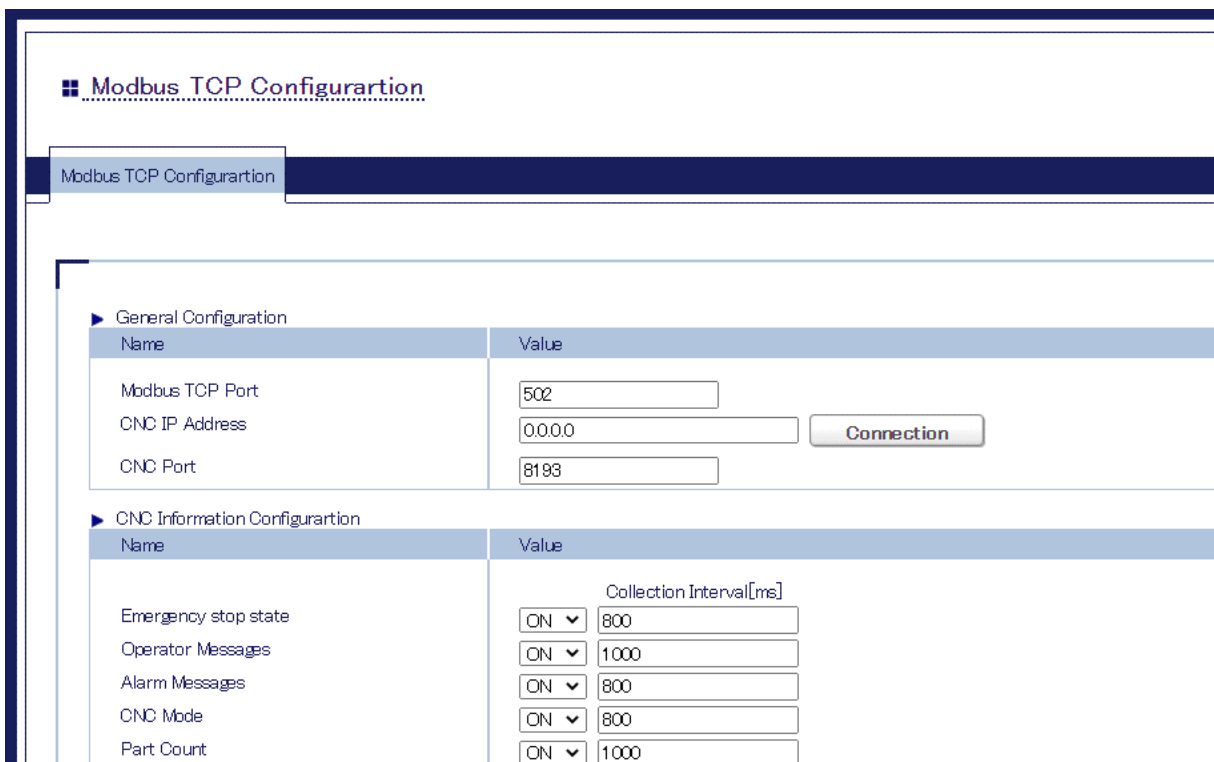
[Data Sample]

- ✓ Character: abc / Data: 0x6162 0x6300
- ✓ Numeric: 12345 / Data: 0x3039
- TCP Keep Alive can be effective under the following settings, which cannot be changed.
  - ✓ Transmission 6 times, transmission interval 10 seconds, time to transmission 60 seconds

## 4.4. Modbus TCP Settings

### [Basic Settings]

- Use FBR-100AN's setting web page to make the settings. For more details, see the PDF product manual.
- Register Modbus TCP communication's port number, and a CNC device's IP address and the communication port number. Select any CNC information you wish to collect and click the setting update button. The settings will take effect after FBR-100AN restarts.
- Only one CNC device can be registered to FBR-100AN.
- The basic settings of Modbus TCP communication are the following three:
  - ✓ Modbus TCP port number: Default (502)
  - ✓ CNC IP address: Default (0.0.0.0)
  - ✓ CNC port number: Default (8193)
- You can select what CNC device information to collect and change the interval (milliseconds) under the CNC information collection settings.



General Configuration	
Name	Value
Modbus TCP Port	502
CNC IP Address	0.0.0.0
CNC Port	8193

CNC Information Configuration	
Name	Value
Emergency stop state	ON <input type="text" value="800"/>
Operator Messages	ON <input type="text" value="1000"/>
Alarm Messages	ON <input type="text" value="800"/>
CNC Mode	ON <input type="text" value="800"/>
Part Count	ON <input type="text" value="1000"/>

Figure 2 : FBR-100AN Setting Web Page

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### [Modbus TCP Status]

You can look at the following information on the setting web page of FBR-100AN. See the PDF product manual for more details on the web page.

- ✓ CNC series (version)
- ✓ Number of PMC paths/channels
- ✓ Number of CNC paths/channels
- ✓ Status (shows the CNC communication status and an error code when a communication error occurs.<sup>2</sup>)

## 5. Collectable Information with FBR-100AN Modbus TCP Activation

The information listed in Appendix can be collected by connecting FBR-100AN and a supported CNC device explained in this document.

For more details of the information, see the **Appendix** in this document.

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<sup>2</sup> The displayed error code is the returned information from the CNC device to FBR-100AN. See the PDF product manual for definitions of the error codes.



## 6. Operation Note

- **Addresses out of the range**

When FBR-100AN receives an address out of the range, it will return an exception code 0x02 (Illegal address).

- **Cycle to get information from CNC device**

- It can be manually set by millisecond (ms).
- The recommended cycle is per between 800 ms and 1,000 ms due to the communication loads on the CNC device.
- FBR-100AN may not collect the information in the specified cycle (communication delay) because of the number of collecting CNC information categories, the communication loads of the CNC device, or the network environment. If this is the case, check and change your network environment (for example, try to use a wired LAN) or reduce the number of collecting CNC information categories. You can choose CNC information categories by changing each setting (ON/OFF) as mentioned in 4.4 "Modbus TCP Setting".

- **Time setting**

When FBR-100AN's NTP (time setting) client is enabled, the Modbus TCP client function of FBR-100AN starts after the time synchronization with the NTP server. If the time cannot be in sync within 360 seconds, FBR-100AN will start the Modbus TCP client before the time sync with the NTP server.

- **Disabling Modbus TCP Activation**

- You can disable it by using FBR-100AN's DIP switch as explained in the setup guide. (Restart FBR-100AN after the change.)
- After disabling the Activation, you can establish FBR-100AN's default MTConnect communications.
- All the setting values that are saved when the Activation is enabled will be kept even after the Activation is disabled and then enabled again.<sup>3</sup>

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<sup>3</sup> To initialize the settings in the Activation mode, refer to the PDF manual and go to FBR-100AN's web setting page.

## Revision History

Ver.	Revision	Date
AN20210901	New issue	Sep 1, 2021

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## Appendix: Collectable CNC Device Information with FBR-100AN ModbusTCP Activation

### ●Address Map of CNC Device Basic Information

#	CNC Information	Address	# of words (2 Bytes)	Value to be stored	Remarks
1	CNC Series	0	64	Character string	
2	Number of PMC paths/channels	64	8	Character string (numeric)	
3	Number of CNC paths/channels	72	8	Character string (numeric)	
4	Status	80	8	AVAILABLE <sup>*1</sup> UNAVAILABLE <sup>*2</sup>	

\*1: It shows that the information is being collected from the CNC device.

\*2: The exception code 0x06 (Slave Busy) is returned as a response for UNAVAILABLE.

### ●Address Map of CNC Device Information

According to "Address Map of CNC Device Basic Information" above, the information can be collected:

- When the Status is AVAILABLE.
- Per CNC path/channel.

#	CNC Information	Address	# of words (2 Bytes)	Value to be stored	Remarks
1	CNC path/channel 1	1000	1500	Refer to "CNC Detailed Information" below.	Modbus TCP master can specify up to 125 words, which is the max data size for read compliant with the Modbus specifications. (1500 words cannot be read at once.)
2	CNC path/channel 2	2500	1500		
3	CNC path/channel 3	4000	1500		
4	CNC path/channel 4	5500	1500		
5	CNC path/channel 5	7000	1500		

### ●Address Map of CNC Device Detailed Information

- The information listed below can be collected per CNC path/channel. The addresses in this list are for CNC path/channel 1.
- Each address includes the start address of the path/channel specified in the "Address Map of CNC Device Information" above.

#	CNC Information	Address	# of words (2 Bytes)	Value to be stored	Remarks
1	Emergency stop status	1000	8	ARMED (The emergency stop state is cancelled.) TRIGGERED (It is in the emergency stop state.)	Only CNC path/channel 1's emergency stop state can be collected. For others, UNAVAILABLE is returned.
2	CNC operation mode	1008	16	MANUAL_DATA_INPUT AUTOMATIC EDIT MANUAL	
3	Number of processed parts	1024	8	Character string (integer)	
4	CNC operating status	1032	8	READY STOPPED INTERRUPTED ACTIVE	
5	Sequence number of the program in operation	1040	8	Character string (integer)	
6	Main program name	1048	64	Character string	Example: //CNC_MEM/USER/PATH1/O4947
7	Main program comment	1112	64	Character string	Example: XH4947 HD1 18-01-05
8	Tool number	1176	8	Character string (integer)	
9	Feed rate override	1184	8	Character string (integer)	
10	Block of the program in operation	1192	64	Character string	Example: O4947(XH4947 HD1 18-01-05)
11	Operation mode of spindle 1	1256	8		
12	Operation mode of spindle 2	1264	8	SPINDLE	
13	Operation mode of spindle 3	1272	8	INDEX	
14	Operation mode of spindle 4	1280	8	CONTOUR	
15	Reserved area				
16	Fast forward override	1300	8	Character string (integer)	
17	Spindle override	1308	8	Character string (integer)	
18	Active axis name	1316	16	Axis name character string (e.g. X1, Z1, C1)	Total 9: Linear axes (X, Y, Z, U, V, W) and Rotating axes (A, B, C)

#	CNC Information	Address	# of words (2 Bytes)	Value to be stored	Remarks
19	Reserved area				
20	Spindle 1 load (%)	1400	8	character string (decimal)	
21	Spindle 1 speed (rotation/min)	1408	8	Character string (integer)	
22	Spindle 2 load (%)	1416	8	character string (decimal)	
23	Spindle 2 speed (rotation/min)	1424	8	Character string (integer)	
24	Spindle 3 load (%)	1432	8	character string (decimal)	
25	Spindle 3 speed (rotation/min)	1440	8	Character string (integer)	
26	Spindle 4 load (%)	1448	8	character string (decimal)	
27	Spindle 4 speed (rotation/min)	1456	8	Character string (integer)	
28	Reserved area				
29	Feed rate (mm/sec)	1500	8	Character string (integer)	
30	Absolute position of X axis (mm)	1508	8	Character string (decimal)	Obtained depending on axis names. Refer to "Active axis name" for axis names.
31	Moving X axis load (%)	1516	8	Character string (decimal)	
32	Moving X axis load current value (%)	1524	8	Character string (decimal)	
33	Moving X axis load current value (A)	1532	8	Character string (decimal)	
34	Absolute position of Y axis (mm)	1540	8	Character string (decimal)	
35	Moving Y axis load (%)	1548	8	Character string (decimal)	
36	Moving Y axis load current value (%)	1556	8	Character string (decimal)	
37	Moving Y axis load current value (A)	1564	8	Character string (decimal)	
38	Absolute position of Z axis (mm)	1572	8	Character string (decimal)	
39	Moving Z axis load (%)	1580	8	Character string (decimal)	
40	Moving Z axis load current value (%)	1588	8	Character string (decimal)	
41	Moving Z axis load current value (A)	1596	8	Character string (decimal)	
42	Absolute position of U axis (mm)	1604	8	Character string (decimal)	
43	Moving U axis load (%)	1612	8	Character string (decimal)	
44	Moving U axis load current value (%)	1620	8	Character string (decimal)	
45	Moving U axis load current value (A)	1628	8	Character string (decimal)	
46	Absolute position of V axis (mm)	1636	8	Character string (decimal)	
47	Moving V axis load (%)	1644	8	Character string (decimal)	
48	Moving V axis load current value (%)	1652	8	Character string (decimal)	
49	Moving V axis load current value (A)	1660	8	Character string (decimal)	
50	Absolute position of W axis (mm)	1668	8	Character string (decimal)	
51	Moving W axis load (%)	1676	8	Character string (decimal)	
52	Moving W axis load current value (%)	1684	8	Character string (decimal)	
53	Moving W axis load current value (A)	1692	8	Character string (decimal)	
54	Absolute position of A axis (mm)	1700	8	Character string (decimal)	
55	Moving A axis load (%)	1708	8	Character string (decimal)	
56	Moving A axis load current value (%)	1716	8	Character string (decimal)	
57	Moving A axis load current value (A)	1724	8	Character string (decimal)	
58	Absolute position of B axis (mm)	1732	8	Character string (decimal)	
59	Moving B axis load (%)	1740	8	Character string (decimal)	
60	Moving B axis load current value (%)	1748	8	Character string (decimal)	
61	Moving B axis load current value (A)	1756	8	Character string (decimal)	
62	Absolute position of C axis (mm)	1764	8	Character string (decimal)	
63	Moving C axis load (%)	1772	8	Character string (decimal)	
64	Moving C axis load current value (%)	1780	8	Character string (decimal)	
65	Moving C axis load current value (A)	1788	8	Character string (decimal)	

#	CNC Information	Address	# of words (2 Bytes)	Value to be stored	Remarks
66	Reserved area				
67	Alarm #1 to Alarm #32 <sup>*3</sup>	1800 2048	8 8	Character string (e.g. SW100)	When an alarm(s) and an operation message(s) occur at the same time, each information will be stored in the corresponding alarm number. <sup>*4</sup> The operation messages are stored only in CNC path/channel 1 because they are independent of the CNC paths/channels.
68	PMC 1 to PMC 10	2100 2118	2 2	Integer number	
69	Macro 1 to Macro 10	2200 2272	8 8	Character string (decimal)	

\*3: For the details about Alarm, please contact makers of your machine tool or CNC device.

\*4: When an alarm(s) and an operation message(s) occur at the same time, the alarm information will be as follows.

E.g. When the alarms are "SW100 and PW100" and the operation message is "1000":

- Alarm #1: SW100
- Alarm #2: PW100
- Alarm #3: 1000