FBR-100AN / FBR-100 Modbus TCP Activation:

Supported CNC Devices and Collectable Information

silex technology

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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 protocol converters for CNC machine tools "FBR-100AN (wireless model) / FBR-100 (wired model)" (referred to as "FBR converter" below).

2. Modbus TCP Activation Specifications

[Modbus TCP Activation Specifications]

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

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[1] See Chapter "5. Collectable Information with FBR Converter Modbus TCP Activation" in this document.

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3. Supported CNC Devices

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

Maker	How to Connect	Model	FBR Converter 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 16i/18i/21i LAN series	See Chapter "5. Collectable Information with FBR Converter Modbus TCP Activation" in this document.

Note: Supported CNC devices/equipment and functions vary depending on FBR converter 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[2]	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

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[2] FBR converter's RS-232C/DPRNT communication functions are compatible with Mitsubishi Electric's CNC M600/M700/M800 series.

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4. Use of FBR Converter 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 converter main unit.
- Refer to the setup guide of FBR converter and register the activation key (alphanumeric characters) you purchased.
- Restart FBR converter after registering the activation key to enable the Modbus TCP settings.

4.2. Modbus TCP Connection Diagram

FBR converter serves as a Modbus TCP slave. Use the device together with a Modbus TCP master.
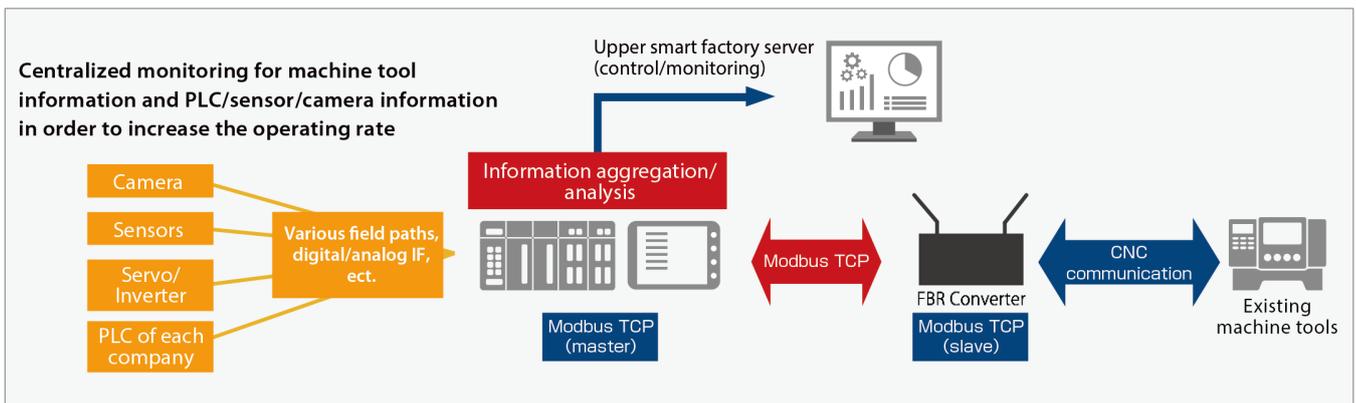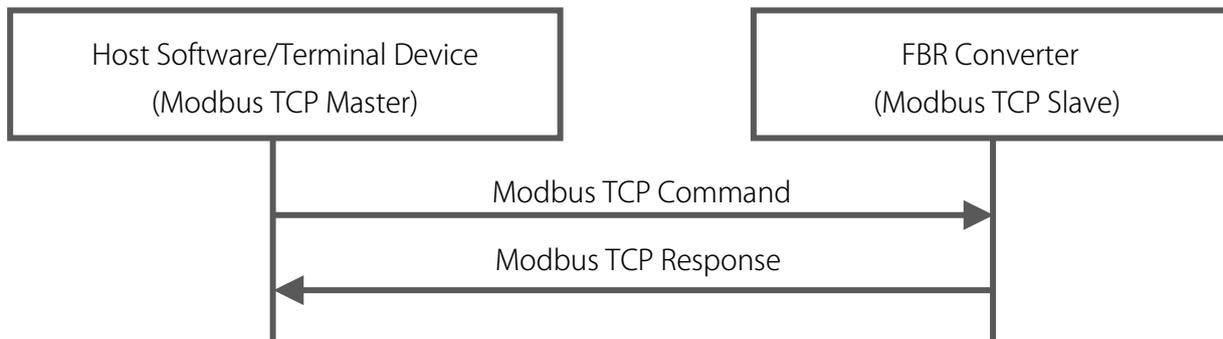

Figure 1: System Configuration for Modbus TCP

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4.3. Modbus TCP Communication

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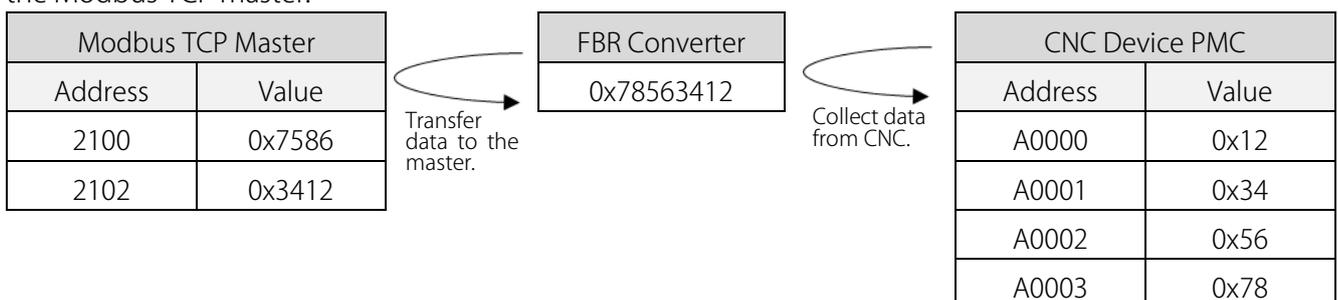

- A single FBR converter, a slave unit in Modbus TCP, can connect to a single Modbus TCP master unit.
- The Modbus TCP master can specify up to 125 words, which is the max data size for read and is compliant with the Modbus specifications.
- The supported command is the function code 0x04 only (read 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.
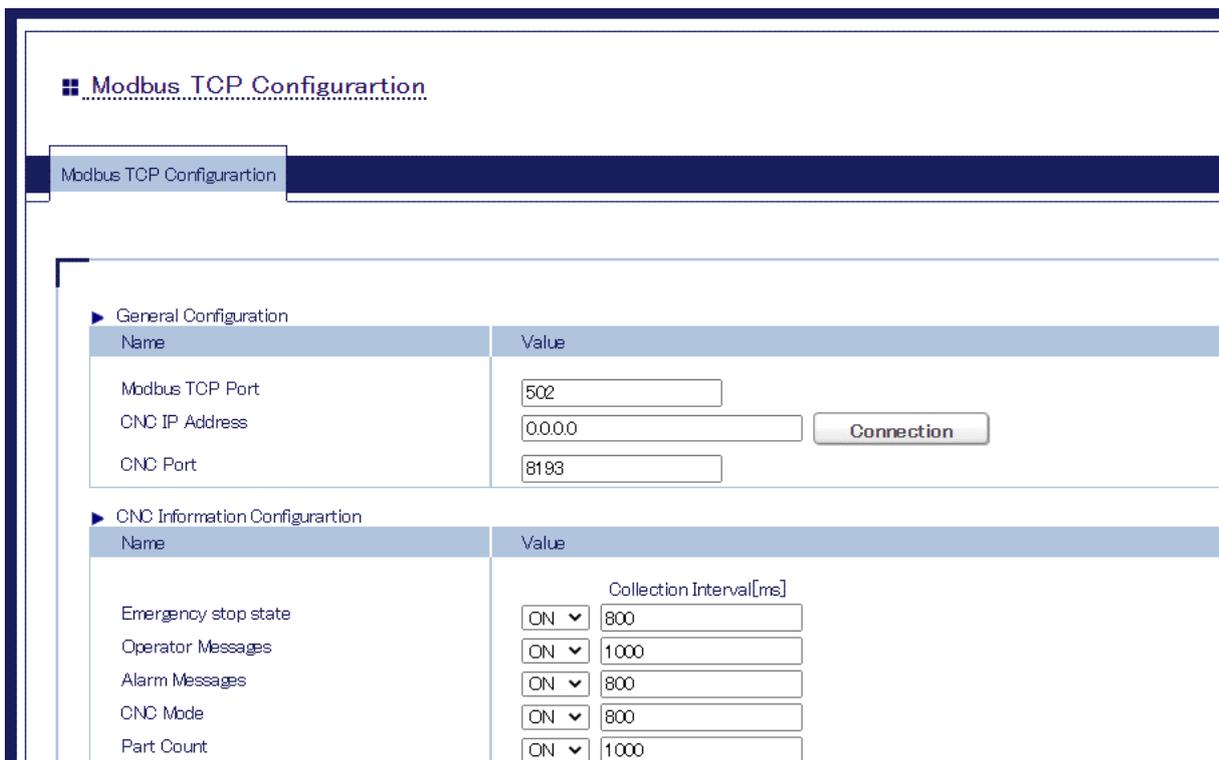 ✓ Transmission 6 times, transmission interval 10 seconds, time to transmission 60 seconds

The following diagram shows an example of how to collect data from PMC in a CNC device. FBR converter obtains the value of two words from the PMC area, swap the bytes (endianness), and transfers the data to the Modbus TCP master.

Modbus TCP Master			FBR Converter		CNC Device PMC	
Address	Value		0x78563412		Address	Value
2100	0x7586	Transfer data to the master.		Collect data from CNC.	A0000	0x12
2102	0x3412				A0001	0x34
					A0002	0x56
					A0003	0x78

4.4. Modbus TCP Settings

[Basic Settings]

- Use FBR converter'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 converter restarts.

- Only one CNC device can be registered to FBR converter.

- 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.

Figure 2: FBR Converter Setting Web Page
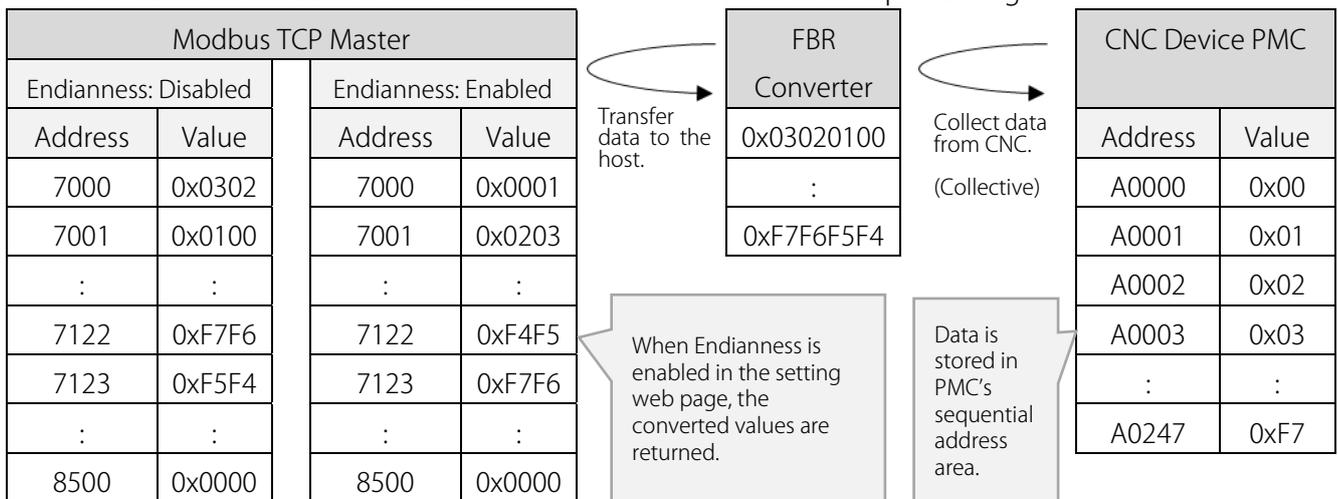
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[PMC Collective Setting]

- Use FBR converter's setting web page to make the setting. See also the product manual (PDF file) for more details.

- FBR converter can collect up to 20 pieces of PMC information. With the collective processing setting, the number will increase up to 750.

- Specify the starting address and amount of PMC information to get collectively.

- The max size of collectable data is 3000 bytes (750 x 4 bytes). Modbus TCP communications, due to the specifications, must be made 12 times to collect the data of 3000 bytes (1500 words).

- The size must be a multiple of 4, otherwise, a setting error will occur.

Note 1) This function works only when "CNC path/channel 5" is not in use.

Note 2) Before using the function, secure a space that can sequentially save the collected data addresses (up to 750 addresses) in PMC of the CNC device. Inquire your machine tool maker about the space.

The following diagram shows an example of how to get data collectively from PMC in a CNC device. FBR converter transfers the data to the Modbus TCP master after collective processing.

Modbus TCP Master					FBR Converter		CNC Device PMC	
Endianness: Disabled		Endianness: Enabled						
Address	Value	Address	Value	Transfer data to the host.	0x03020100	Collect data from CNC.	Address	Value
7000	0x0302	7000	0x0001		:	(Collective)	A0000	0x00
7001	0x0100	7001	0x0203		0xF7F6F5F4		A0001	0x01
:	:	:	:				A0002	0x02
7122	0xF7F6	7122	0xF4F5	When Endianness is enabled in the setting web page, the converted values are returned.		Data is stored in PMC's sequential address area.	A0003	0x03
7123	0xF5F4	7123	0xF7F6				:	:
:	:	:	:				A0247	0xF7
8500	0x0000	8500	0x0000					

CNC Information Configuration (PMC Collective)

Name	Value
PMC Path Number	1
Address Type	A
Starting Address	
Size[Byte]	0
Collection Interval[ms]	1000
Byte Swapping (Endian)	DISABLE

Figure 3: FBR Converter Setting Web Page (PMC Collective)

[Modbus TCP Status]

You can look at the following information on the setting web page of FBR converter. 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, error codes and their meaning when a communication error occurs, and the Help screen.)

5. Collectable Information with FBR Converter Modbus TCP Activation

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

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

6. Operation Note

- **Return values: when CNC data acquisition is OFF for particular information**
  FBR converter returns the following values to the Modbus TCP server.
  - Alarm #1 to #32   : Empty
  - PMC1 to PMC20   : 0
  - Others   : UNAVAILABLE

- **Addresses out of the range**
  When FBR converter 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 converter 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 Settings".

- **Time setting**
  When FBR converter's NTP (time setting) client is enabled, the Modbus TCP client function starts after the time synchronization with the NTP server. If the time cannot be in sync within 360 seconds, FBR converter 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 converter's DIP switch as explained in the setup guide. (Restart FBR converter after the change.)
  - Although the Activation is disabled, you can establish the default MTConnect communications.
  - FBR converter will keep the setting values in the Activation mode, even though the Activation is disabled and then enabled again.[3]

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[3] To initialize the settings in the Activation mode, refer to the PDF manual and go to FBR converter's web setting page.

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- **How to check CNC device's communication settings**

  In order to set the CNC device's network information (IP addresses and communication ports) on FBR converter, go through the following steps to find the necessary information.

  FANUC CNC Devices:

  - Press the [SYSTEM] key on the control panel of the CNC device. -> Press the soft key [EMBED PORT]. -> Press the soft key [COMMON] -> Find its IP address and subnet mask.
  - Press the soft key [FOCAS] -> Find the TCP port number. It is typically 8193, but is not always assigned.

  Note 3) To connect FBR converter with FANUC fast Ethernet board, press [ETHER BOARD] instead of [EMBED PORT].

  Note 4) When no IP address, subnet mask or port number is assigned, set up the CNC device according to the manual. CNC devices usually require a restart (power OFF/ON) to apply changes.

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Revision History

Ver.	Revision	Date
AN20210901	New issue	Sep 1, 2021
AN20210901XA	Added CNC information configurations on FBR-100AN	Sep 13, 2021

AN20210901XB	・ Included FBR-100 wired LAN model.
	・ 4.3. Modbus TCP Communication: Added an example of PMC data acquisition from CNC machine.
	・ 5. Collectable Information with FBR Converter Modbus TCP Activation: Added more information that can be monitored with the latest firmware ver. 1.4.3 and more remarks in the Appendix.
	・ 6. Operation Note: Added the following:
	  ➢ Values to be returned when FBR converter's CNC data acquisition is OFF for specific information.
	  ➢ How to find FANUC CNC devices' IP address and communication port number.
		Feb 09, 2022

AN20210901XC	・ 4.4 Modbus TCP Settings: Added the PMC collective processing function. ・ Added some restrictions to " Appendix: Collectable Information with FBR Converter Modbus TCP Activation.	Mar 22, 2022

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

● **Address Map of CNC Device Basic Information**

#	CNC Information	Address	# of words (2 Bytes)	Value to be stored	Frequency (Default)	Remarks
1	CNC Series	0	64	Character string	Only at boot-up	Model information of the CNC device
2	Number of PMC paths/channels	64	8	Character string (integer)	Only at boot-up	How many PMC paths/channels exist.
3	Number of CNC paths/channels	72	8	Character string (integer)	Only at boot-up	How many CNC paths/channels exist. (Generally, same as the number of spindles)
4	Status	80	8	AVAILABLE[1] UNAVAILABLE[2]	800 ms	Showing communications are dead or alive.
5	All Servo and Spindle power consumption (0.001kWh)	88	8	Character string (integer)	5000 ms	Integrated value of the power of all the servos and spindles. This will visualize all the power consumed by the machine tools as an approximation, and can be used to check CO_2 emissions/carbon footprints. Note: This value is only obtained from 30i/0i series.

*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.) When CNC path/channel 5 is not in use, its address can be exclusively used for PMC batch processing. Use the batch process function to collect more than 20 pieces of PMC information (up to 750 pieces).
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 (Can be used for PMC batch processing when not in use.)	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	Frequency (Default)	Remarks
1	Emergency stop status	1000	8	ARMED (The emergency stop state is cancelled.) TRIGGERED (It is in the emergency stop state.)	800 ms	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	800 ms	Shows the current operation mode of the machine tool.
3	Number of processed parts	1024	8	Character string (integer)	1000 ms	Shows the number of manufacturing processes done by the machine tool.
4	CNC operating status	1032	8	READY STOPPED INTERRUPTED ACTIVE	800 ms	Shows the current operation status of the machine tool.
5	Sequence number of the program in operation	1040	8	Character string (integer)	800 ms	Shows the execution sequence of the process programs.
6	Main program name	1048	64	Character string	2000 ms	Name of the process program. This can be used in the host monitoring software to check work categories. Example: //CNC_MEM/USER/PATH1/O4947

#	CNC Information	Address	# of words (2 Bytes)	Value to be stored	Frequency (Default)	Remarks
7	Main program comment	1112	64	Character string	2000 ms	Supplemental information that is added to each process program. This can be used in the host monitoring software to check work categories. Example: XH4947 HD1 18-01-05
8	Tool number	1176	8	Character string (integer)	800 ms	ID of a tool added to the machine tool.
9	Feed rate override	1184	8	Character string (integer)	1000 ms	Shows the work speed of the machine tool (percentage %, approximately equal to the efficiency). Set or change this, if necessary, to check process programs or tune process conditions.
10	Block of the program in operation	1192	64	Character string	800 ms	Shows information of each block in the current process program. Use this to debug or check programs. Example: O4947(XH4947 HD1 18-01-05)
11	Operation mode of spindle 1	1256	8	SPINDLE INDEX CONTOUR	800 ms	Shows the spindle's operation mode.
12	Operation mode of spindle 2	1264	8		800 ms	Same as above.
13	Operation mode of spindle 3	1272	8		800 ms	Same as above.
14	Operation mode of spindle 4	1280	8		800 ms	Same as above.
15	Reserved area					
16	Fast forward override	1300	8	Character string (integer)	1000 ms	Shows the work speed of the machine tool (percentage %, approximately equal to the efficiency). Set or change this, if necessary, to check process programs or tune process conditions.
17	Spindle override	1308	8	Character string (integer)	1000 ms	Same as above.
18	Active axis name	1316	16	Axis name character string (e.g. X1, Z1, C1)	5000 ms	Present axis information available in the machine tool. Total 9: Linear axes (X, Y, Z, U, V, W) and Rotating axes (A, B, C)
19	Dry run	1332	8	ENABLED DISABLED	800 ms	This is a mode to be used for NC program functional tests, and will be useful for screening operating hours of machine tools by using the host monitoring software. Note: This value is only obtained from 30i/0i series.
20	Cutting feed	1340	8	ENABLED DISABLED	800 ms	Indicates cutting feed orders issued by the NC program. This value will be useful for screening operation hours of machine tools by using the host monitoring software. Note: This value is only obtained from 30i/0i series.
21	M00	1348	8	ENABLED DISABLED	800 ms	This will be useful for screening operation hours of machine tools by using the host monitoring software. You can also use this to check dimensions and tool conditions when you stop the machine in the middle of manufacturing. Note: This value is only obtained from 30i/0i series.
22	M01	1356	8	ENABLED DISABLED	800 ms	This will be useful for screening operation hours of machine tools by using the host monitoring software. This is used when you do not need to check the second and subsequent work because you have checked the first work quality. Note: This value is only obtained from 30i/0i series.
23	Cycle time (sec)	1364	8	Character string (decimal)	800 ms	This is the time duration from the start of cutting work to the end (integrated value of automatic operation hours in one cycle). This is used to optimize the manufacturing hours and identify a cause of work variation.

#	CNC Information	Address	# of words (2 Bytes)	Value to be stored	Frequency (Default)	Remarks
24	Reserved area					
25	Spindle 1 load (%)	1400	8	Character string (decimal)	800 ms	Show the load (approximately equal to the cutting torque) and the rotational speed of each spindle. These can be reference values when you set processing conditions or estimate the lifetime of tools. The optimal value will vary by work category/hardness.

Note: For machines not equipped with a position coder, NC parameters may need to be changed (change the bit in No. 3118 to 1). |
26	Spindle 1 speed (rotation/min)	1408	8	Character string (integer)	800 ms	
27	Spindle 2 load (%)	1416	8	Character string (decimal)	800 ms	
28	Spindle 2 speed (rotation/min)	1424	8	Character string (integer)	800 ms	
29	Spindle 3 load (%)	1432	8	Character string (decimal)	800 ms	
30	Spindle 3 speed (rotation/min)	1440	8	Character string (integer)	800 ms	
31	Spindle 4 load (%)	1448	8	Character string (decimal)	800 ms	
32	Spindle 4 speed (rotation/min)	1456	8	Character string (integer)	800 ms	
33	Spindle insulation resistance value of Spindle 1 (MΩ)	1464	8	Character string (decimal)	5000 ms	These insulation resistance values of spindle motors can be used as reference values for preventive maintenance. These values generally vary from 0 to around 100. (A value of 10 or below indicates that the associated parts should be replaced.) These values will be updated when the CNC device's emergency stop button is pressed. Some of the emergency stop buttons need to be pressed before the machine tool is powered off.

Note: These value are only obtained from 30i/0i series. |
34	Spindle insulation resistance value of Spindle 2 (MΩ)	1472	8	Character string (decimal)	5000 ms	
35	Spindle insulation resistance value of Spindle 3 (MΩ)	1480	8	Character string (decimal)	5000 ms	
36	Spindle insulation resistance value of Spindle 4 (MΩ)	1488	8	Character string (decimal)	5000 ms	

#	CNC Information	Address	# of words (2 Bytes)	Value to be stored	Frequency (Default)	Remarks
37	Reserved area					
38	Feed rate (mm/sec)	1500	8	Character string (integer)	800 ms	Move speed of the feed rod.
39	Absolute position of X axis (mm)	1508	8	Character string (decimal)	800 ms	
40	Moving X axis load (%)	1516	8	Character string (decimal)	800 ms	
41	Moving X axis load current value (%)	1524	8	Character string (decimal)	800 ms	
42	Moving X axis load current value (A)	1532	8	Character string (decimal)	800 ms	
43	Absolute position of Y axis (mm)	1540	8	Character string (decimal)	800 ms	
44	Moving Y axis load (%)	1548	8	Character string (decimal)	800 ms	
45	Moving Y axis load current value (%)	1556	8	Character string (decimal)	800 ms	
46	Moving Y axis load current value (A)	1564	8	Character string (decimal)	800 ms	Obtained depending on axis names. Refer to "Active axis name" for the axis name.
47	Absolute position of Z axis (mm)	1572	8	Character string (decimal)	800 ms	
48	Moving Z axis load (%)	1580	8	Character string (decimal)	800 ms	Note: The moving axis load current values are only obtained from 30i/0i series.
49	Moving Z axis load current value (%)	1588	8	Character string (decimal)	800 ms	
50	Moving Z axis load current value (A)	1596	8	Character string (decimal)	800 ms	
51	Absolute position of U axis (mm)	1604	8	Character string (decimal)	800 ms	If you use an axis not named X, Y, Z, U, V, W, A, B, or C, the value of the axis will be stored in an unused reserved area, which will be selected in order of this list.
52	Moving U axis load (%)	1612	8	Character string (decimal)	800 ms	
53	Moving U axis load current value (%)	1620	8	Character string (decimal)	800 ms	
54	Moving U axis load current value (A)	1628	8	Character string (decimal)	800 ms	
55	Absolute position of V axis (mm)	1636	8	Character string (decimal)	800 ms	
56	Moving V axis load (%)	1644	8	Character string (decimal)	800 ms	Example: 1: When CNC axes were named X, Y, and T, the value of T will be stored in Z's area (The axis "Z" has not been used.)
57	Moving V axis load current value (%)	1652	8	Character string (decimal)	800 ms	
58	Moving V axis load current value (A)	1660	8	Character string (decimal)	800 ms	2: When CNC axes were named A, B, and T, the value of T will be stored in X's area. (The axis "X" has not been used.)
59	Absolute position of W axis (mm)	1668	8	Character string (decimal)	800 ms	
60	Moving W axis load (%)	1676	8	Character string (decimal)	800 ms	
61	Moving W axis load current value (%)	1684	8	Character string (decimal)	800 ms	The electric load current value of each axis (approximately same as the load information) can be used as a reference value when you set processing conditions or estimate the lifetime of tools. (The load current value, due to the accuracy, should rather be used as a trend value of moving average.) The optimal value will vary by work category/hardness.
62	Moving W axis load current value (A)	1692	8	Character string (decimal)	800 ms	
63	Absolute position of A axis (mm)	1700	8	Character string (decimal)	800 ms	
64	Moving A axis load (%)	1708	8	Character string (decimal)	800 ms	
65	Moving A axis load current value (%)	1716	8	Character string (decimal)	800 ms	
66	Moving A axis load current value (A)	1724	8	Character string (decimal)	800 ms	
67	Absolute position of B axis (mm)	1732	8	Character string (decimal)	800 ms	
68	Moving B axis load (%)	1740	8	Character string (decimal)	800 ms	
69	Moving B axis load current value (%)	1748	8	Character string (decimal)	800 ms	
70	Moving B axis load current value (A)	1756	8	Character string (decimal)	800 ms	
71	Absolute position of C axis (mm)	1764	8	Character string (decimal)	800 ms	
72	Moving C axis load (%)	1772	8	Character string (decimal)	800 ms	
73	Moving C axis load current value (%)	1780	8	Character string (decimal)	800 ms	
74	Moving C axis load current value (A)	1788	8	Character string (decimal)	800 ms	
75	Reserved area					
76	Alarm #1 to Alarm #32[*3]	1800 to 2048	8	Character string (e.g. SW100)	800 ms	When an alarm(s) and an operation message(s) occur at the same time, each information will be stored in the corresponding alarm number.[*4] The operation messages are stored only in CNC path/channel 1 because they are independent of the CNC paths/channels.
77						
78	PMC 1 to PMC 20	2100 to 2138	2	Integer number	1000 ms	Register up to 20 PMC as needed depending on the machine tool builder and the users.

#	CNC Information	Address	# of words (2 Bytes)	Value to be stored	Frequency (Default)	Remarks
79						
80	Macro 1 to Macro 10	2200 to 2272	8	Character string (decimal)	1000 ms	Register up to 10 Macro as needed depending on the machine tool builder and the users.
81	Moving axis insulation resistance value of X axis (MΩ)	2280	8	Character string (decimal)	5000 ms	Obtained depending on axis names. Refer to "Active axis name" for the axis name. Note: These values are only obtained from 30i/0i series. Each spindle motor's insulation resistance value and axis travel amount can be used as reference values for preventive maintenance. The insulation resistance values generally vary from 0 to around 100. (A value of 10 or below indicates that the associated parts should be replaced.) These values will be updated when the CNC device's emergency stop button is pressed. Some of the emergency stop buttons need to be pressed before the machine tool is powered off.
82	Moving axis insulation resistance value of Y axis (MΩ)	2288	8	Character string (decimal)	5000 ms	
83	Moving axis insulation resistance value of Z axis (MΩ)	2296	8	Character string (decimal)	5000 ms	
84	Moving axis insulation resistance value of U axis (MΩ)	2304	8	Character string (decimal)	5000 ms	
85	Moving axis insulation resistance value of V axis (MΩ)	2312	8	Character string (decimal)	5000 ms	
86	Moving axis insulation resistance value of W axis (MΩ)	2320	8	Character string (decimal)	5000 ms	
87	Moving axis insulation resistance value of A axis (MΩ)	2328	8	Character string (decimal)	5000 ms	
88	Moving axis insulation resistance value of B axis (MΩ)	2336	8	Character string (decimal)	5000 ms	
89	Moving axis insulation resistance value of C axis (MΩ)	2344	8	Character string (decimal)	5000 ms	
90	X axis total travel amount	2352	8	Character string (integer)	800 ms	Obtained depending on axis names. Refer to "Active axis name" for the axis name. These values can be used as reference values for preventive maintenance and life management of the feed rod. Note: Legacy CNC devices including 16i series require an optional function to show the total travel amount.
91	Y axis total travel amount	2360	8	Character string (integer)	800 ms	
92	Z axis total travel amount	2368	8	Character string (integer)	800 ms	
93	U axis total travel amount	2376	8	Character string (integer)	800 ms	
94	V axis total travel amount	2384	8	Character string (integer)	800 ms	
95	W axis total travel amount	2392	8	Character string (integer)	800 ms	
96	A axis total travel amount	2400	8	Character string (integer)	800 ms	
97	B axis total travel amount	2408	8	Character string (integer)	800 ms	
98	C axis total travel amount	2416	8	Character string (integer)	800 ms	
99	Real speed for servo adjustment of X axis (rotation/min)	2424	8	Character string (integer)	800ms	Shows the real speed of each axis for servo adjustment. It can be used as a reference value to detect abnormalities by comparing it with the following values: - Spindle speed (rotation), load, and load current values obtained by FBR converter - Position deviation of the servo obtained by other devices.
100	Real speed for servo adjustment of Y axis (rotation/min)	2432	8	Character string (integer)	800ms	
101	Real speed for servo adjustment of Z axis (rotation/min)	2440	8	Character string (integer)	800ms	
102	Real speed for servo adjustment of U axis (rotation/min)	2448	8	Character string (integer)	800ms	
103	Real speed for servo adjustment of V axis (rotation/min)	2456	8	Character string (integer)	800ms	
104	Real speed for servo adjustment of W axis (rotation/min)	2464	8	Character string (integer)	800ms	
105	Real speed for servo adjustment of A axis (rotation/min)	2472	8	Character string (integer)	800ms	
106	Real speed for servo adjustment of B axis (rotation/min)	2480	8	Character string (integer)	800ms	
107	Real speed for servo adjustment of C axis (rotation/min)	2488	8	Character string (integer)	800ms	

*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

●CNC information configurations on FBR converter
  - Use FBR converter's setting web page to make the settings. For more details, see the PDF product manual.
  - To collect PMC information (1 to 20) and Macro information (1 to 10) in this document, set the number of paths/channels and the address information
    manually from FBR converter's setting web page.

FBR Converter Setting Web Page for Modbus TCP