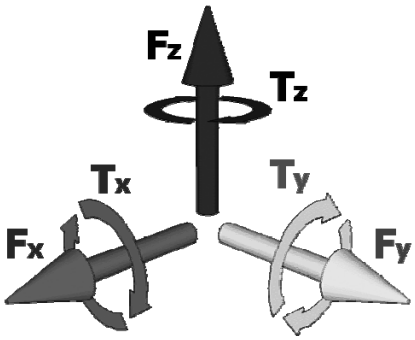
6 Axis Force Torque Sensor
RFT Series

EtherCAT I/F Manual

REVISION 0.1

(RFT-ECAT-V1)



ROBOTOUS Co., Ltd.

Contents

1. Caution

1.1. Notices

⚠ The user must read and understand all of the instructions in this manual before using the RFT series F/T sensors.

⚠ This manual covers installation, operation, specification, and ordering information of RFT series F/T sensors..

1.2. Warning

⚠ Do not install and operate a F/T sensor that is damaged or lacking some parts.

⚠ Do not disassemble or repair the sensor for any purpose. This may cause irreparable damage to the sensor and void the warranty.

⚠ Always take payload applied to the F/T sensor into consideration for safe usage.

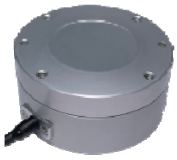
⚠ Do not exert excessive forces or torques on the sensor. This can create incorrect measurement and cause damage to the sensor. When force is applied to the sensor, torque is exerted on the sensor simultaneously. Make sure all components of force and torque stay within allowed ranges. Even if a component of them exceeds its limit, this may result in incorrect measurement of the other component. Refer to Section 4.2 Performance Specifications.

⚠ If the sensor experiences a sudden change in temperature and humidity, the sensor's temperature correction feature may no longer function correctly and cause erratic sensor output. Please ensure the sensor is not subject to sudden changes in temperature and humidity.

⚠ Do not remove or damage the label on sensor to maintain warranty.

2. Installation

2.1. Overview: RFT models with an embedded EtherCAT board

Item	RFT80-6A02-E	RFT64-6A01-E	-
Product Image			-
Temp. Compensation	●	●	-

2.2. Power Specifications

Item	**RFT models** with an embedded EtherCAT board
Input voltage	5 Vdc
Power consumption	Max. 1 W
Warning	Input voltage tolerance: ±10% **The F/T sensor may be damaged if input voltage exceeds the limits**.

2.3. Wiring

The default sensor cable of RFT models with an embedded EtherCAT board is as follows.

Please be careful not to change the polarity of input voltage.

3. EtherCAT Bus Interface

The EtherCAT Bus Interface of RFT Series provides the following functions.

- Reading sensor information
  - Model Name
  - Serial Number
  - Firmware Version
- Setting up the sensor
  - Bias Control
  - Setting the cut-off frequency of low-pass filter(software filter)
- Reading overload counts of each axis
- Reading 6-axis force/torque data
- Reading current overload status and temperature of the sensor

3.1. PDO(Process Data Objects) Mapping

The PDO(Process Data Objects) are used to send/receive data in real time.

- TxPDO : Input Data to the EtherCAT master
  - **Object 0x6000** is mapped.
  - Object 0x6000 contains Force / Torque data, sensor status and temperature value.
- RxPDO: Input Data to the sensor
  - Currently, reserved for future use.

3.2. SDO(Service Data Objects) : EtherCAT Dictionary Objects

3.2.1. Object 0x2000 : Sensor Information

This object has 3 entries for reading the sensor information. A user(EtherCAT Master) can only read data.

Sub index	Entry Name	Data Type	Description
1	Model Name	STRING(16)	16bytes read-only data for Model Name
2	Serial Number	STRING(16)	16bytes read-only data for Serial Number
3	Firmware Version	STRING(16)	16bytes read-only data for Firmware Version

3.2.2. **Object 0x2001 : Sensor Setup**

This object has 2 entries to setup the configuration of sensor signal processing. A user(EtherCAT master) can also read-back setup data.

Sub index	Entry Name	Data Type	Description
1	BIAS	UINT16	16bit read-write data for BIAS Setup. Biasing : write **non-zero** value (ex. 1) Un-biasing: write **0** NOTE 1. If a sensor is biased, read-back value is 1. 2. Unbiasing not required before biasing. 3. This value is not saved and is restored to 0(un-biased) when the power is turned on again.
2	LPF Setup	UINT16	16bit read-write data for setting cut-off frequency of low-pass filter. This value is saved after turn-off. The unit of this value is **Hz**. If you want to get raw data (not filtered), write **0 or 1000**. The range of cut-off frequency is **1~500**(Hz).

3.2.3. **Object 0x2002 : Overload Counter**

This object has 6 entries of overload counts. The maximum number of counts is 255.

Sub index	Entry Name	Data Type	Description
1	Fx	UINT8	Number of overload occurrence of Fx
2	Fy	UINT8	Number of overload occurrence of Fy
3	Fz	UINT8	Number of overload occurrence of Fz
4	Tx	UINT8	Number of overload occurrence of Tx
5	Ty	UINT8	Number of overload occurrence of Ty
6	Tz	UINT8	Number of overload occurrence of Tz

3.2.4. **Object 0x6000: TxPDO**

This object has 8 entries which are used to transfer force/torque data, sensor status and temperature value. All entries are read-only.

Sub index	Entry Name	Data Type	Description
1	Fx	REAL32	32bit floating-point value for measured Fx Unit: N (Newton)
2	Fy	REAL32	32bit floating-point value for measured Fy Unit: N (Newton)
3	Fz	REAL32	32bit floating-point value for measured Fz Unit: N (Newton)
4	Tx	REAL32	32bit floating-point value for measured Tx Unit: Nm (Newton-meter)
5	Ty	REAL32	32bit floating-point value for measured Ty Unit: Nm (Newton-meter)
6	Tz	REAL32	32bit floating-point value for measured Tz Unit: Nm (Newton-meter)
7	FTS-Status	UINT32	32bit unsigned integer for overload status. Bit 5: if overloaded at Fx,, set to 1. Bit 4: if overloaded at Fy,, set to 1. Bit 3: if overloaded at Fz,, set to 1. Bit 2: if overloaded at Tx,, set to 1. Bit 1: if overloaded at Ty,, set to 1. Bit 0: if overloaded at Tz,, set to 1. Bit6~31: reserved
8	Temperature [Celsius]	REAL32	32bit floating-point value of sensor temperature. Unit: ℃ (celsius temperature)

3.2.5. **Object 0x7000: RxPDO**

This object is not available to the users and reserved for future use.

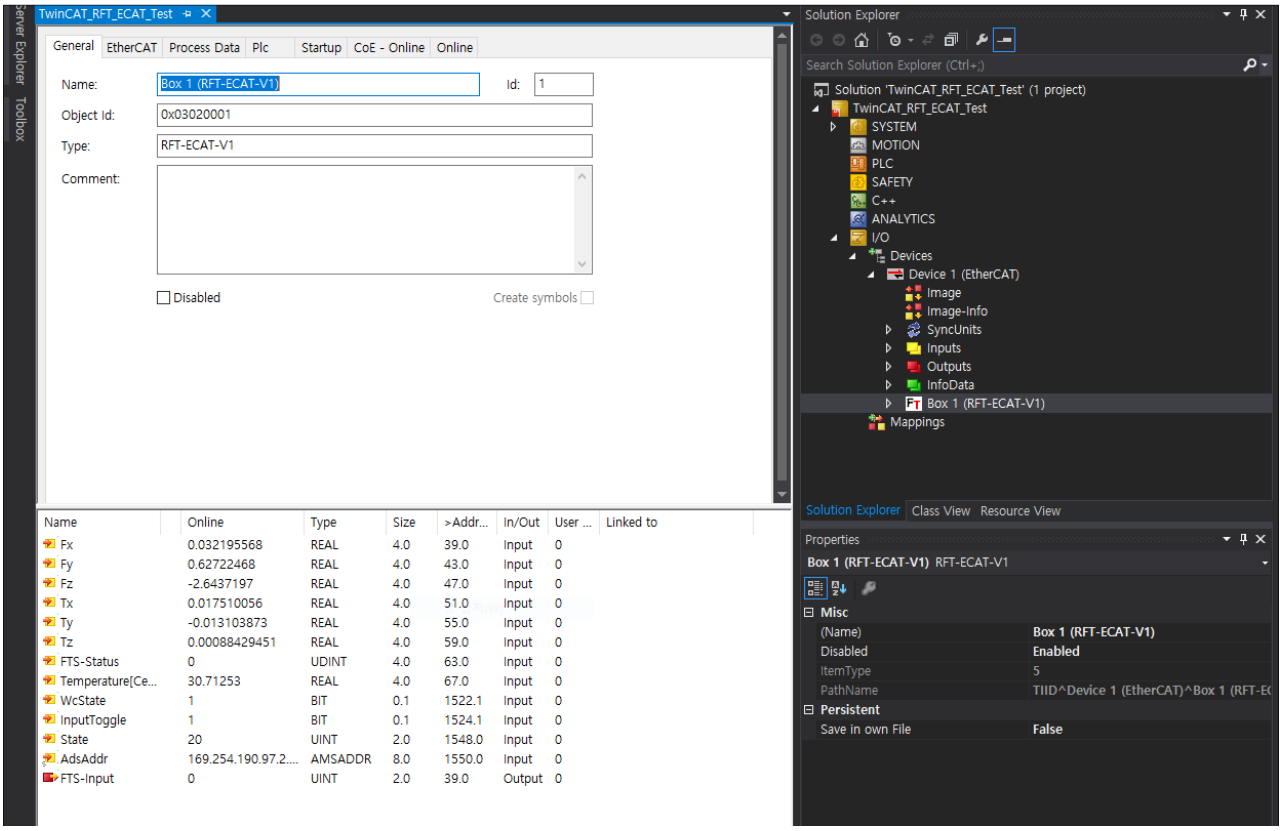
4. Testing the EtherCAT Adaper Using TwinCAT

4.1. ESI(EtherCAT Slave Information) XML File for TwinCAT (Windows 10, TwinCAT Ver 3.1)

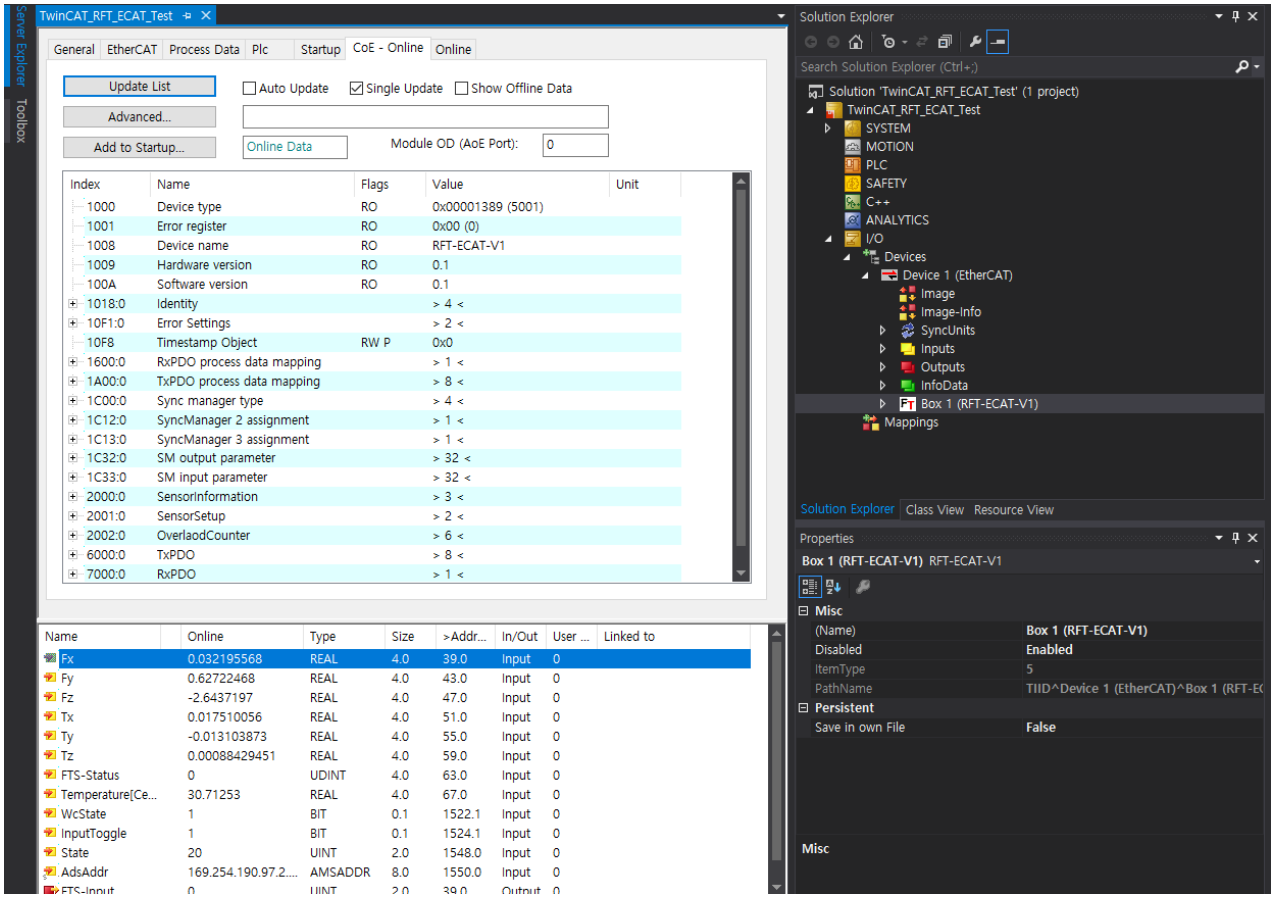
- XML file name: **RFT-ECAT-V1.xml**
- Location of XML file: **C:\TwinCAT\3.1\Config\Io\EtherCAT**

4.2. Sequence of Testing

- Step 1. Create a TwinCAT project using Visual Studio.
- Step 2. Connect a LAN cable to EtherCAT Master (Ethernet adapter).
- Step 3. Turn on RFT sensor.
- Step 4. Scan the device.
- Step 5. Activate the TwinCAT in free-run mode
- Step 6. Observe the output values of PDO(Process Data Object) and SDO(Service Data Object)



Test using TwinCAT – PDO



Test using TwinCAT - SDO

5. Contact Information (Technical Support)

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