

Sapphire Capacitance Diaphragm Gauge

Model V8

User's Manual

for EtherCAT

Communication Functions

Thank you for purchasing your Azbil Corporation product.

This manual contains information for ensuring the safe and correct use of the product.

Those designing or maintaining equipment that uses this product should first read and understand this manual. This manual contains information not only for installation, but also for maintenance, troubleshooting, etc. Be sure to keep it nearby for handy reference.

Azbil Corporation

NOTICE

Please make sure that this manual is available to the user of the product.

Unauthorized duplication of this user's manual in part or in whole is forbidden. The information and specifications in this manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is complete and accurate, but if you should find an omission or error, please contact us.



In no event is Azbil Corporation liable to anyone for any indirect, special, or consequential damages as a result of using this product.

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EtherCAT® is a registered trademark and the patented technology is licensed from Beckhoff Automation GmbH, Germany.

Conventions Used in This Manual

- The safety precautions explained below aim to prevent injury to you and others, and to prevent property damage.

	WARNING	Warnings are indicated when mishandling this product may result in death or serious injury.
	CAUTION	Cautions are indicated when mishandling this product may result in minor injury or property damage only.

- In describing the product, this manual uses the icons and conventions listed below.



Indicates that caution is required in handling.



The indicated action is prohibited.



Be sure to follow the indicated instructions.



Handling Precautions:

Information to be aware of when handling.



Note:

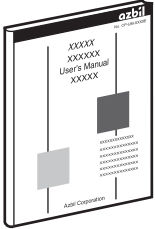
Indicates information that may be useful.



Indicates an item or page to which the user may refer.

The Role of This Manual

There are four different manuals related to model V8. Read them as necessary for your specific requirements. If you do not have a manual you require, please contact us or one of our dealers.



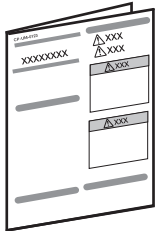
Sapphire Capacitance Diaphragm Gauge Model V8 User's Manual for EtherCAT Communication Functions

Document No. CP-SP-1471E

This manual.

This manual provides information necessary for EtherCAT slave communication using the model V8 sapphire capacitance diaphragm gauge. Be sure to read this manual when using EtherCAT communication.

The manual covers the basics of communication, as well as object dictionaries, exception status, and ESI files.



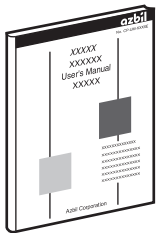
Sapphire Capacitance Diaphragm Gauge Integrated Model V8C User's Manual

Document No. CP-UM-5998JE

Sapphire Capacitance Diaphragm Gauge Separated Model V8S User's Manual

Document No. CP-UM-5999JE

Personnel in charge of the design and/or manufacture of equipment that uses the model V8 sapphire capacitance diaphragm gauge should read this manual thoroughly. The manual covers safety precautions, installation, wiring, and primary specifications.



User's Manual for Smart Loader Package Model SLP-V8 for Sapphire Capacitance Diaphragm Gauge Model V8

Document No. CP-SP-1472E

This manual describes the software used on a personal computer to configure the model V8 sapphire capacitance diaphragm gauge. Personnel in charge of design and/or manufacturing of equipment that uses the V8 should read this manual thoroughly.

This manual also describes the installation of the software on a personal computer, the operation of the PC, various functions, and setup procedures.

EtherCAT Communication

EtherCat® is an Ethernet-based real-time fieldbus system proposed and developed by Beckhoff Automation GmbH, Germany. Since it is based on the Ethernet protocol, general-purpose Ethernet cables can be used when setting up a network.

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Chapter 1. Overview


■ The EtherCAT interface

Item	Description	Notes
Communication protocol	A special protocol for EtherCAT	-
Communication standards	IEC 61158-2 (Ed. 4.0) IEC 61158-3/4/5/6-12 (Ed 1.0)	-
Data rate	100 Mbps	-
Device identification method	Explicit Device Identification is supported.	Rotary switches for ID selector
Physical layer	100BASE-Tx (IEEE 802.3)	-
Connector	RJ-45 8-pin socket × 2 <IN> EtherCAT input <OUT> EtherCAT output	-
Cable	Sealed twisted pair (STP) cable with Cat. 5e or higher	Either a straight cable or a crossover cable can be used.
Cable length	30 m max.	-
Applicable profile	Semiconductor Device Profile – Part 1 Common Device Profile	ETG.5003-1 S(R) V1.1.0
	Semiconductor Device Profile – Part 2080 Specific Device Profile: Vacuum Pressure Gauge	ETG.5003.2080 S (R) V1.3.0 1.5.0 (OD)
Mailbox (CoE)	SDO data access with CoE is supported	-
Synchronization mode	FreeRun, SM synchronization	Cycle: 0.27 ms
Topology	Line, tree, star, daisy chain	-

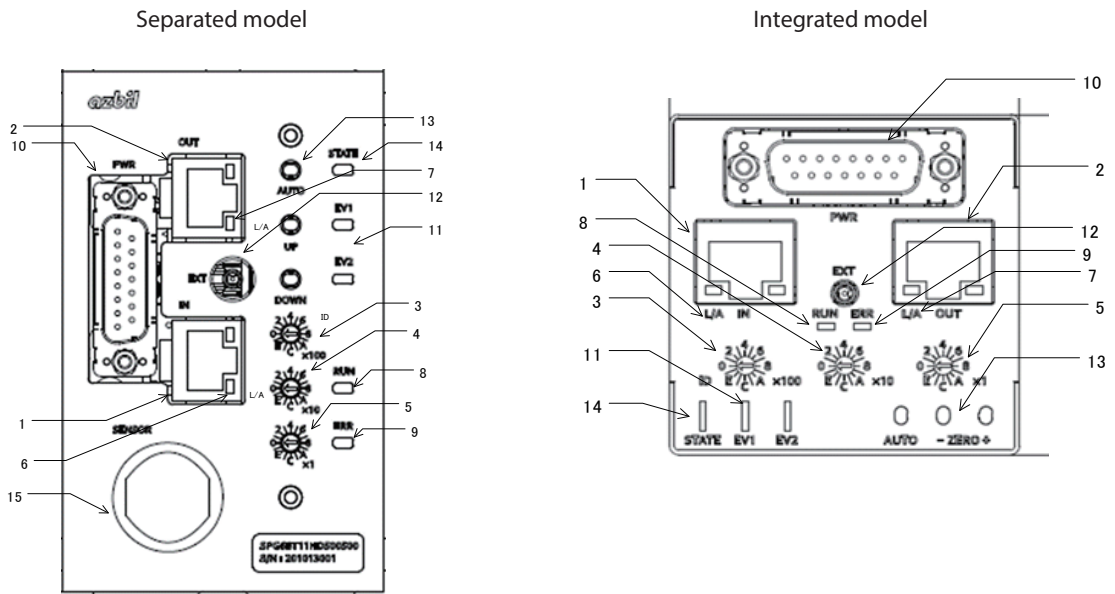
■ Definition of terms

Term	Description
Model with self-heating function	The temperature of the gauge head is controlled. Specify by model number.
Model without self-heating function	The temperature of the gauge head is not controlled. Specify by model number.
Model with variable self-heating temperature	The temperature of the gauge head is controlled and the temperature setting can be changed. Specify by model number.
Smart Loader Package	Software that runs on a PC and is necessary for monitoring the internal data of this product and for configuring the settings (model number: SLP-V8______)

Note

-  ■ EtherCAT terms (p. App.-2) (for terms related to EtherCAT)

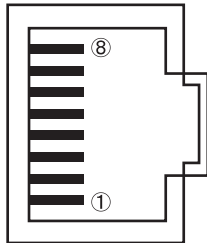
■ Appearance



No.	Label	Description
1	IN	EtherCAT IN connector
2	OUT	EtherCAT OUT connector
3	ID × 100	Rotary switches for ID selector ×100 (hex.)
4	×10	Rotary switch for ID selector ×10 (hex.)
5	×1	Rotary switch for ID selector ×1 (hex.)
6	L/A	Link Activity EtherCAT IN
7	L/A	Link Activity EtherCAT OUT
8	RUN	EtherCAT status LED
9	ERR	EtherCAT error LED
10	PWR	Sensor cable connector (power, analog output, relay output, DI)
11	EV1, EV2	Event relay output LED
12	EXT	Loader jack
13	AUTO/DOWN/UP, AUTO/-ZERO+	Zero point adjustment button
14	STATE	State LED
15	Gauge head	Gauge head connector

■ Connector pin assignment

The network ports of this device are used as follows.



Connector on this device

Pin No.	Signal	Description
1	TX +	Transmitted data (+)
2	TX -	Transmitted data (-)
3	RX +	Received data (+)
4	-	75 Ω terminating resistor connection
5	-	75 Ω terminating resistor connection
6	RX -	Received data (-)
7	-	75 Ω terminating resistor connection
8	-	75 Ω terminating resistor connection

■ Cable and connection method

A shielded twisted pair (STP) cable of Cat. 5 or higher category can be used. Either a straight cable or a crossover cable can be used.

Connect the network cable from the master device to the IN port (RJ connector) of this device. Additionally, if this device has a slave on the downstream side, connect the OUT port (RJ connector) of this device to the IN port of the slave device with a network cable.

! Handling Precautions

- Do not use the EtherCAT communication network for other Ethernet communications.

■ LED indicator and switches

● LED

LED	Color	LED state	Description
RUN	Green	Off	The device is in initialization (INIT) status or is not turned on.
		Blinking	Pre-operational status (PREOP)
		Single flash	Safe-operational status (SAFEOP) Communication of cyclic data is in progress. The input data (TxPDO) is valid, but the output data (RxPDO) is not output. Note: Data sent from the master (RxPDO) will not be saved on the V8.
		Flickering	BOOT (Bootstrap status)
ERR	Red	Off	An EtherCAT error has not occurred or the device is not turned on.
		Blinking	An EtherCAT error has occurred (incorrect setting).
		Single flash	An application error in the device has changed the requested EtherCAT state.
		Double flash	Timeout of sync manager watchdog has occurred.
		On	Lit when a PDI watchdog timeout has occurred. Note that this functionality is not supported by this device.
STATE	Green	On	Operating normally
		Blinking	Warning
	Red	On	Error
		Blinking	Alarm
	Orange	On	Heater warm-up in progress
	Green/red/orange	–	Zero point adjustment in progress (☞ <i>Sapphire Capacitance Diaphragm Gauge Integrated Model V8C User's Manual (CP-UM-5998JE)</i> and ☞ <i>Sapphire Capacitance Diaphragm Gauge Separated Model V8S User's Manual (CP-UM-5999JE)</i>)
–	Off	Powered off	
EV1, EV2	Green	On	Output from the corresponding event relay (1–2) is turned on.
		Off	Output from the corresponding event relay (1–2) is turned off.
		EV1 and EV2 are lit alternately	An initialization error has occurred, BOOT (Bootstrap status)
L/A	Green	Off	The cable is not connected to the ports or the device is not turned on.
		Flickering	The cable is connected to the ports and the device is communicating.
		On	The cable is connected to the ports but there is currently no communication activity.

RUN/ERR LED state definition	ON/OFF duration
Blinking	200 ms ON, 200 ms OFF
Single flash	200 ms ON, 1000 ms OFF
Double flash	200 ms ON, 200 ms OFF, 200 ms ON, 1000 ms OFF
Flickering	50 ms ON, 50 ms OFF

● Rotary switches for ID selector

To specify an EtherCAT device ID, use the three rotary switches with hexadecimal symbols (0–F). The specified value is used as an Explicit Device Identification, as defined in the EtherCAT specifications.



The switches with $\times 100$, $\times 10$, and $\times 1$ labels correspond to the 3rd, 2nd, and 1st digit of a hexadecimal number respectively.

The master device can obtain an ID by reading an Explicit Device Identification or a station alias specified in the SII.

Ex.: If the rotary switches for ID selector are set as shown below, the device ID is $0x100 \times 0xC + 0x10 \times 0xC + 0x1 \times 0xC = 0xCCC$ (3276 in decimal notation).



■ Pressure value

The pressure (“Value”) is calculated with the following formula, using the pre-compensation pressure:

$$\text{Pressure} = \text{GCS} \times (\text{pre-compensation pressure} + \text{AZO}) + \text{OCS}$$

The values of GCS, AZO, and OCS are determined by the following objects.

Term	Name	Index	Subindex	Access*1
Value	Pressure	0x6000	0x11	RO
GCS	Gain Customer Specified	0x8001	0x13	RW
AZO*2,3	Accumulated Zero Offset	0x9000	0x01	RO
OCS	Offset Customer Specified	0x8001	0x12	RW

*1. RO: read only, RW: read and write

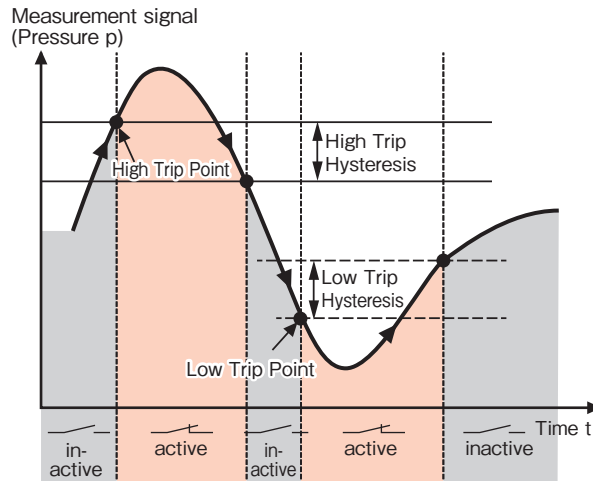
*2. AZO is a read-only object for the zero point adjustment value, so data cannot be directly written to it from EtherCAT.

*3. The value can be changed by pressing the zero point adjustment buttons. (👉 *Sapphire Capacitance Diaphragm Gauge Integrated Model V8C User’s Manual (CP-UM-5998JE)* and 👉 *Sapphire Capacitance Diaphragm Gauge Separated Model V8S User’s Manual (CP-UM-5999JE)*)

■ Trip point

Two trip points are provided by default, and up to four can be configured.

The behavior of trip points are shown below.



Trip points 1 and 2 are objects defined in ETG.5003.2080, *Vacuum Pressure Gauge*.

Trip points 3 and 4 are extended functions provided by this device, so they do not support some of the functions found in trip points 1 and 2.

The functions available for each trip point are indicated in the table below.

TPn means the number n trip point (n= 1, 2, 3, or 4).


✓: supported

– : not supported

Name	TP1/TP2	TP3/TP4
High Trip Enable	✓	✓
Low Trip Enable	✓	✓
Polarity	✓	✓
Override enable	✓	–
Override High Trip	✓	–
Override Low Trip	✓	–
High Trip Point Limit	✓	✓
Low Trip Point Limit	✓	✓
High Trip Hysteresis	✓	✓
Low Trip Hysteresis	✓	✓



Note

- For assignment of objects, refer to  Chapter 2. Object Dictionary.

■ Event output

This device has four (PhotoMOS) event output ports.

The following functions can be assigned to an event.

The polarity of the output can be changed.

Name	Abbrev.	Function selection
Event 1	EV1	<ul style="list-style-type: none"> • Outputs trip point (TP1) • Outputs trip point (TP1) or warm-up*
Event 2	EV2	<ul style="list-style-type: none"> • Outputs trip point (TP2) • Outputs trip point (TP2) or warm-up*
Event 3	EV3	<ul style="list-style-type: none"> • Outputs trip point (TP3) • Outputs warm-up status
Event 4	EV4	<ul style="list-style-type: none"> • Outputs trip point (TP4) • Outputs error or alarm status • Outputs latched error or alarm status

* The function cannot be specified by EtherCAT communication. Use the Smart Loader Package.

● Trip point output

Trip points can be assigned to event outputs.



Note

- ■ Trip point (p. 1-6) (for details of trip points)

Function name	Description	Objects related to settings
Outputs trip point (TP1)	The result of OR (logical sum) operation of TP1 "High Trip Point Limit: ON" and "Low Trip Point Limit: ON" is output.	0x800E
Outputs trip point (TP2)	The result of OR operation of TP2 "High Trip Point Limit: ON" and "Low Trip Point Limit: ON" is output.	0x800F
Outputs trip point (TP3)	The result of OR operation of TP3 "High Trip Point Limit: ON" and "Low Trip Point Limit: ON" is output.	0x4001
Outputs trip point (TP4)	The result of OR operation of TP4 "High Trip Point Limit: ON" and "Low Trip Point Limit: ON" is output.	0x4002

The relationship between trip point output and event output is shown below.

Trip point output	Event output	
	Output polarity: positive	Output polarity: negative
OFF	Open	Closed
ON	Close	Open

● Warm-up status output

Warm-up completion status is output. The definition differs depending on the model.

Warm-up status output	Product	
	Model with self-heating function	Model without self-heating function
OFF	Warm-up is not completed.*	Always ON
ON	Warm-up is completed.*	

* Warm-up is complete when the following condition is met:

- The self-heating temperature is ± 1 °C of the setting.

The relationship between warm-up status output and event output is shown below.

Warm-up status output	Event output	
	Output polarity: positive	Output polarity: negative
OFF	Open	Close
ON	Close	Open

● Error/alarm status output

The error/alarm status is output.

Error/alarm status output	Description
OFF	An error or alarm has occurred.
ON	No error or alarm has occurred.

The relationship between error/alarm status output and event output is shown below.

Error/alarm status output	Event output	
	Output polarity: positive	Output polarity: negative
OFF	Open	Close
ON	Close	Open

● Latched error/alarm status output

Latched error/alarm status is output.

Latched error/ alarm status output	Description
OFF	There is a latched error or alarm.
ON	There is no latched error or alarm.

The relationship between latched error/alarm status output and event output is shown below.

Latched error/ alarm status output	Event output	
	Output polarity: positive	Output polarity: negative
OFF	Open	Close
ON	Close	Open

■ PDO mapping

The default TxPDO mapping is as follows.

PDO Index	PDO SubIndex	PDO Entry Index	PDO Entry Subindex	Data type	Name
0x1A00	0x01	6001	0x01	BOOL	Reading Valid*1
	0x02	6001	0x02	BOOL	Overrange Exceeded
	0x03	6001	0x03	BOOL	Underrange Exceeded
	0x04	0000	0x00	Bit 5	(Padding bits)
	0x05	6000	0x11	FLOAT	Sensor Value*2
	0x06	F641	0x01	UINT	Trip Point Output All Instance
0x1BFE	0x01	F380	–	USINT	Active Exception Status
	0x02	F641	0x01	UINT	Trip Point Output All Instance

*1. The reading is valid if all of the following conditions are met:

- No error or alarm has occurred.
- The sensor value is within the accuracy-guaranteed range.
- The self-heating temperature is ± 1 °C of the setting (this condition applies only to models with self-heating function)

This is not affected by whether the trip point (TP) is valid or invalid.

*2. The sensor value is not guaranteed if reading validity is set to Invalid.

There is no default RxPDO mapping.

TxPDO: 16 entries max.

RxPDO: 4 entries max.

Handling Precautions





- Set the communication cycle of the master device to 200 μ s or more. If it is set to less than 200 μ s, malfunction of the product may result.

Chapter 2. Object Dictionary

The general structure of the CoE object dictionary is as follows (all the index numbers in the following tables are in hexadecimal notation).

Index	Object dictionary areas
1000–1FFF	Communication profile area
2000–5FFF	Manufacturer-specific profile area
6000–6FFF	Input area
7000–7FFF	Output area
8000–8FFF	Configuration area
9000–9FFF	Information area
A000–AFFF	Diagnosis area
B000–BFFF	Service transfer area
C000–EFFF	Reserved area
F000–FFFF	Device area

Note

- For object dictionary (OD) specifications, refer to the following documents:
 -  ETG.1000.5 S (R) V1.0.4: *EtherCAT Specification, Part 5*
 -  ETG.5001.1 S (D) V0.9.0: *Part 1: General MDP Device Model*
 -  ETG.5003-1 S (R) V1.1.0: *Semiconductor Device Profile, Part 1: Common Device Profile*
 -  ETG.5003.2080 S (R) V1.3.0 | 1.5.0 (OD): *Part 2080: Specific Device Profile: Vacuum Pressure Gauge*

Handling Precautions

- Values written to the objects shown below will be valid immediately.

Index	Name
8001	Configuration Capacitance Diaphragm
800E	Configuration Trip Point 1
800F	Configuration TripPoint 2

- Values written to the objects shown below will not be valid immediately. To make the new settings valid, execute the Store Parameters Command (0xFB2).

Index	Name
4000	Analog output Configuration
4001	Relay 3 configuration
4002	Relay4 configuration
4003	Misc.configuration
F840	Configuration Device

- The value of an object with Access = RW and nv (nonvolatile) attributes can be stored in nonvolatile memory (NVRAM). To do so, execute the Store Parameters Command (0xFBF2). Note that, if the power is turned off or the setting is reset without saving the value to NVRAM, a change in the value will be invalid (the setting will revert to the previously stored value).
- Be sure to write a value within the setting range to an object. If a value outside the range is written, operation will be unreliable. Also, a user parameter alarm (A01) or user parameter warning (W01) may occur.
- If values are written simultaneously from EtherCAT and the Smart Loader Package to the same object, the resulting setting will be uncertain, which may cause unreliable operation of the product. Make sure that values are not written simultaneously to the same object from EtherCAT and from the Smart Loader Package.

The following tables give details for each object.


■ Communication Profile Objects (0x1000–0x1FFF)

Index	Object Code/Sl	Data type	Access	Value	Name
1000	VAR	UDINT	RO	0x138b	Device Type
1001	VAR	USINT	RO	0x00	Error register*1
1008	VAR	V_STRING	RO	"V8"	Manufacturer Device name
1009	VAR	V_STRING	RO	E.g., "1.1.1.1"	Manufacturer Hardware Version
100A	VAR	V_STRING	RO	E.g., "1.2.51"	Manufacturer Software Version
100B	VAR	V_STRING	RO	"0.0.00"	Manufacturer Bootloader Version
1018	RECORD	Identity Object			
	0x01	UDINT	RO	0x00000629	Vendor ID (EEPROM)
	0x02	UDINT	RO	0x00000004	Product Code (EEPROM)
	0x03	UDINT	RO	E.g., 0x00000004	Revision Number (EEPROM)
	0x04	UDINT	RO	0x00000000	Serial Number (EEPROM)
10F1	RECORD	Error Settings*2			
	0x01	UDINT	RW	1	Local Error Reaction
	0x02	UINT	RW	4	Sync Error Counter Limit
10F3	RECORD	Diagnosis History			
	0x01-37	Refer to ETG.1020 (Protocol Enhancements) for details.*3			
10F8	VAR	ULINT	RO	–	Timestamp Object
1600	RECORD	Output Common Process Data Mapping (2 entries max.)			
	0x01–0x02	UDINT	RW	0x00000000	(Reserved for user application)
1601	RECORD	Output Mapping 1 (2 entries max.)			
	0x01–0x02	UDINT	RW	0x00000000	(Reserved for user application)
17FE	RECORD	Output Device Mapping (2 entries max.)			
	0x01–0x02	UDINT	RW	0x00000000	(Reserved for user application)
17FF	RECORD	Output User-Specific Device Mapping (2 entries max.)			
	0x01–0x02	UDINT	RW	0x00000000	(Reserved for user application)
1A00	RECORD	Single Gauge Input Mapping (8 entries max.)			
	0x01	UDINT	RW	0x60010101	Reading Valid
	0x02	UDINT	RW	0x60010201	Overrange Exceeded
	0x03	UDINT	RW	0x60010301	Underrange Exceeded
	0x04	UDINT	RW	0x00000005	---
	0x05	UDINT	RW	0x60001120	Sensor Value
	0x06	UDINT	RW	0xF6410120	Trip Point Output All Instance
	0x07	UDINT	RW	0x00000000	(Reserved for user application)
	0x08	UDINT	RW	0x00000000	(Reserved for user application)
1A01	RECORD	Input Mapping 1 (8 entries max.)			
	0x01–0x08	UDINT	RW	0x00000000	(Reserved for user application)
1BFE	RECORD	Input Device Mapping (4 entries max.)			
	0x01	UDINT	RW	0xF3800008	Active Exception Status
	0x02	UDINT	RW	0xF6410120	Trip Point Output All Instance
	0x03–0x04	UDINT	RW	0x00000000	(Reserved for user application)
1BFF	RECORD	Input User-Specific Device Mapping (4 entries max.)			
	0x01–0x04	UDINT	RW	0x00000000	(Reserved for user application)

Index	Object Code/Sl	Data type	Access	Value	Name
1C00	ARRAY	Sync Manager Type			
	0x01	USINT	RO	0x01	MailBox write
	0x02	USINT	RO	0x02	MailBox read
	0x03	USINT	RO	0x03	Process output data
	0x04	USINT	RO	0x04	Process input data
1C12	ARRAY	Sync Manager 2 Assignment (max. array size is 2)			
	0x01–0x02	UINT	RW	0x0000	(Reserved for user application)
1C13	ARRAY	Sync Manager 3 Assignment (max. array size is 4)			
	0x01	UINT	RW	0x1A00	Default TxPDO
	0x02	UINT	RW	0x1BFE	Default TxPDO
	0x03–0x04	UINT	RW	0x0000	(Reserved for user application)
1C32	RECORD	Output Sync Manager Parameter (see later chapters)			
1C33	RECORD	Input Sync Manager Parameter (see later chapters)			

*1. Functions related to the defined Error Register are not supported. 0x00 is always read out.

*2. Functions related to the defined Error Setting Object are not supported.

*3. For the specifications of Diagnosis History and further information, refer to  ■ Diagnosis History (p. 2-27).

■ Sync Manager Parameter (0x1C32, 0x1C33)

Sync Manager Parameter Values (0x1C32, 0x1C33)

SI	Name	Access	Use	Value	Note
1	Synchronization Type	RO	M	0x0000 or 0x0001	FreeRun, SM synchronous
2	Cycle Time*	RO	O	0	Local cycle time of application controller
4	Synchronization Types Supported	RO	M	0x4003	FreeRun, SM synchronous
5	Minimum Cycle Time	RO	C	0x41eb0	0.27 ms

* This device does not support Cycle Time.

■ Manufacturer-Specific Profile Objects (0x2000–0x5FFF)

Index	Object Code/SI	Data type	Access	rx/tx, nv*1	Name
2000–2FFF		Manufacturer-specific inputs (no specific input supported)			
2000	0x01	USINT	RO		Digital Input (0: OFF, 1: ON) Bit 3: DI 4 Bit 2: DI 3 Bit 1: DI 2 Bit 0: DI 1
3000–3FFF		Manufacturer-specific outputs (no specific output supported)			
4000–4FFF		Manufacturer-specific configuration data			
4000	RECORD	Analog output configuration			
	0x01	REAL	RW	nv	Pressure at 0 V output
	0x02	REAL	RW	nv	Pressure at 10 V output
	0x03	REAL	RW	nv	Output value on error ^{r*9}
	0x04	USINT	RW	nv	Output mode on error ^{r*9}
	0x05	USINT	–	–	Undefined
	0x06	REAL	RW	nv	Actual output at 0 V (V) ^{*2}
	0x07	REAL	RW	nv	Actual output at 10 V (V) ^{*2}
4001	RECORD	Relay 3 configuration			
	0x01	USINT	RW	nv	Output mode
	0x02	USINT	RW	nv	Function selection
	0x03	REAL	RW	nv	High Trip Point Limit ^{*3}
	0x04	REAL	RW	nv	Low Trip Point Limit ^{*3}
	0x05	REAL	RW	nv	High Trip Hysteresis ^{*3}
	0x06	REAL	RW	nv	Low Trip Hysteresis ^{*3}
4002	RECORD	Relay 4 configuration			
	0x01	USINT	RW	nv	Output mode
	0x02	USINT	RW	nv	Function selection
	0x03	REAL	RW	nv	High Trip Point Limit ^{*3}
	0x04	REAL	RW	nv	Low Trip Point Limit ^{*3}
	0x05	REAL	RW	nv	High Trip Hysteresis ^{*3}
	0x06	REAL	RW	nv	Low Trip Hysteresis ^{*3}
4003	RECORD	Misc. configuration			
	0x01	–	–	–	Reserved
	0x02	UINT	RW	nv	PV filter coefficient (msec)
	0x03	UINT	RW	nv	Auto zero adjustment warning level ^{*4}
	0x04	UDINT	RW	nv	Maintenance due time (min)
	0x05	UINT	RW	nv	Aux. PV filter coefficient (ms)
	0x06	USINT	RW	nv	Sensor Temperature Source
	0x07	USINT	RW	nv	DI function

Index	Object Code/Sl	Data type	Access	rx/tx, nv*1	Name
5000–5FFF		Manufacturer-specific information data			
5000	VAR	V_STR	RO	nv	Manufacturer's model number
5001	RECORD	Module internal information			
	0x01	UINT	RO	tx	Relay 1/2/3/4 (1: Close, 0: Open)
					Bit 3: Relay 4
					Bit 2: Relay 3
					Bit 1: Relay 2
					Bit 0: Relay 1
	0x02	REAL	RO	tx	Auxiliary pressure*5
	0x03	REAL	RO	tx	Maximum pressure since power-on*10
	0x04	REAL	RO	tx	Board temperature (°C)
	0x05	REAL	RO	tx	Sensor temperature (°C)
	0x06	REAL	RO	tx	Heater temperature (°C)*8
	0x07	REAL	RO	tx	Heater current (mA)*8
	0x08	REAL	RO	tx	Power supply voltage (V)
0x09	REAL	RO	tx	Sensor temperature setting (°C)*8	
0x0A	UINT	RO	tx	Temperature status*8 Bit 0: Not at temperature*7	
5002	RECORD	Module-specific exception status			
	0x01	UDINT	RO	tx	Error (👉 ■ Error (p. 3-1))
	0x02	UDINT	RO	tx	Alarm (👉 ■ Alarm (p. 3-2))
	0x03	UDINT	RO	tx	Warning (👉 ■ Warning (p. 3-2))
	0x04	UDINT	RO	tx	Information (👉 ■ Info (p. 3-4))
5003	ARRAY	Exception history data			
	0x01–0x10	UDINT	RO	–	Exception history*6

*1. Abbreviations; rx: RxPDO mappable object, tx: TxPDO mappable object, nv: nonvolatile data

*2. 👉 User's Manual for Smart Loader Package Model SLP-V8 for Sapphire Capacitance Diaphragm Gauge Model V8, CP-SP-1472E.

*3. A warning will be issued if an invalid parameter value was specified.
Valid parameter conditions
High Trip Point Limit ≥ Low Trip Point Limit
Low Trip Point Limit + Low Trip Hysteresis ≤ High Trip Point Limit – High Trip Hysteresis
High Trip Hysteresis ≥ 0
Low Trip Hysteresis ≥ 0

*4. When 1: 0.1 % FS, when 12: 1.2 % FS

*5. Precision of an auxiliary pressure value is not guaranteed because it is a reference value if an abnormal pressure is detected.

*6. The history of abnormalities after power-on.

*7. Even if there is an error or alarm, bit 0 will be "0" if the temperature is ±1 °C of the specified value.

*8. The setting is available only for models with a self-heating function.

*9. If either setting is specified, the status of analog output may become unreliable if any of the following exceptions occurs.
A01: user parameter, A13: model/calibration parameter, E28: program ROM, E26: RAM, E29: initialization error,
E30: run-time error

*10. Data will not be retained if a power failure occurs. It will be reset to 0 when the power is turned back on.
If the unit of pressure is changed, the previous unit setting continues to apply until the next time the maximum pressure is updated.

● Analog Output Setting (0x4000)

SI	Name	Unit	Description	Setting range	Default
0x01	Pressure at 0 V output	*1	The pressure when 0 V is output can be specified.	–300 to +300 % FS of the pressure range specified for the model	0 % FS of the pressure range specified for the model
0x02	Pressure at 10 V output	*1	The pressure when 10 V is output can be specified.	–300 to +300 % FS of the pressure range specified for the model	+100 % FS of the pressure range specified for the model
0x03	Output value on error	V	The value to be output when there is an error or alarm can be specified. If “Specified value” is selected for [Output mode on error], this value will be output.	–1.000 to +11.500 V	+11.500 V
0x04	Output mode on error	–	The value that is output when an error or alarm occurs can be changed.	0: Normal (the measured pressure, regardless of errors) 1: Last good value (before the error/ alarm occurred) 2: Specified value (set in [Output value on error (0x4000.0x03)]) 3: Minimum value (-1.0 V) 4: Maximum value (11.5 V)	0: Normal (the measured pressure, regardless of errors)
0x06	Actual output at 0 V*2	V	The voltage measured with a measuring instrument when 0 V is output by forced 0–10 V output can be written.*2	–2.000 to +2.000 V	0.000 V
0x07	Actual output at 10 V*2	V	The voltage measured with a measuring instrument when 10 V is output by forced 0–10 V output can be written.*2	8.000 to 12.000 V	10.000 V

*1. Unit of pressure set in Data Units (0xF840.0x01).

*2.  User's Manual for Smart Loader Package Model SLP-V8 for Sapphire Capacitance Diaphragm Gauge Model V8, CP-SP-1472E (for detailed operation).

● Relay 3 Configuration (0x4001)

SI	Name	Unit	Description	Setting range	Default
0x01	Output mode	–	Enables or disables the High/Low Trip Point Limit judgment. Specifies the polarity (positive/negative) of event output.	Bit 0: Polarity (0: positive, 1: negative) Bit 1: Low limit judgment (0: disabled, 1: enabled) Bit 2: High limit judgment (0: disabled, 1: enabled)	Bit 0: 0 (positive) Bit 1: 0 (disabled) Bit 2: 0 (disabled)
0x02	Function selection	–	Selects what to output from the event.	0: Outputs trip point 1: Outputs warm-up status Other: (disabled)	1: Outputs warm-up status
0x03	High Trip Point Limit	*	Specifies the High Trip Point Limit.	–10 to +110 % FS of the pressure range specified for the model	+110 % FS of the pressure range specified for the model
0x04	Low Trip Point Limit	*	Specifies the Low Trip Point Limit.	–10 to +110 % FS of the pressure range specified for the model	+50 % FS of the pressure range specified for the model
0x05	High Trip Hysteresis	*	Specifies the High Trip Hysteresis.	0 to +20 % FS of the pressure range specified for the model	0.5 % FS of the pressure range specified for the model
0x06	Low Trip Hysteresis	*	Specifies the Low Trip Hysteresis.	0 to +20 % FS of the pressure range specified for the model	0.5 % FS of the pressure range specified for the model

* Unit of pressure set in Data Units (0xF840.0x01).

Note: The status of relay 3 output may become unreliable if any of the following exceptions occurs.

A01: user parameter, A13: model/calibration parameter, E28: program ROM, E26: RAM, E29: initialization error, E30: run-time error

● Relay 4 Configuration (0x4002)

SI	Name	Unit	Description	Setting range	Default
0x01	Output mode	–	Enables or disables the High/Low Trip Point Limit judgment. Specifies the polarity (positive/negative) of event output.	Bit 0: Polarity (0: positive, 1: negative) Bit 1: Low limit judgment (0: disabled, 1: enabled) Bit 2: High limit judgment (0: disabled, 1: enabled)	Bit 0: 0 (positive) Bit 1: 0 (disabled) Bit 2: 0 (disabled)
0x02	Function selection	–	Selects what to output from the event.	0: Outputs trip point 2: Outputs error or alarm status 3: Outputs latched error/ alarm status Other: (disabled)	2: Outputs error or alarm status
0x03	High Trip Point Limit	*	Specifies the High Trip Point Limit.	–10 to +110 % FS of the pressure range specified for the model	+110 % FS of the pressure range specified for the model
0x04	Low Trip Point Limit	*	Specifies the Low Trip Point Limit.	–10 to +110 % FS of the pressure range specified for the model	+50 % FS of the pressure range specified for the model
0x05	High Trip Hysteresis	*	Specifies the High Trip Hysteresis.	0 to +20 % FS of the pressure range specified for the model	0.5 % FS of the pressure range specified for the model
0x06	Low Trip Hysteresis	*	Specifies the Low Trip Hysteresis.	0 to +20 % FS of the pressure range specified for the model	0.5 % FS of the pressure range specified for the model

* Unit of pressure set in Data Units (0xF840.0x01).

Note: If [Function selection] is set to "Outputs error or alarm status," the relay output may not be correct if any of the following exceptions occur.

A01: user parameter, A13: model/calibration parameter, E28: program ROM, E26: RAM, E29: initializing error, E30: run-time error



● Misc. Configuration (0x4003)

SI	Name	Unit	Description	Setting range	Default
0x02	PV filter coefficient	ms	The time constant for a first-order lag filter (digital processing) for the measured pressure reading can be specified.	0 to 10000 ms	30 ms
0x03	Auto zero adjustment warning level	% FS	<p>When automatic zero adjustment is complete, the STATE LED on this device blinks four times.</p> <p>How much drift from 0 % FS has occurred (the amount for zero adjustment) can be understood from the color of the LED (green, orange, red).</p> <p>Drift amount: small (green), medium (orange), large (red)</p> <p>The threshold at which green turns to orange can be specified as a percentage of the full scale value (default : 5 % FS).</p> <p>Note: If the amount of zero adjustment exceeds ± 20 % FS, the red LED blinks four times.</p>	0.0 to 20.0 % FS of the range specified for the model	5.0 % FS of the range specified for the model
0x04	Maintenance due time	min	<p>Time until next maintenance can be set.</p> <p>If "Time since power-on" exceeds the time set for [Maintenance due time], a warning (exception status) will be issued.</p>	0 to 14400000 min	0 min
0x05	Aux. PV filter coefficient	ms	The time constant for a first-order lag filter (digital processing) for the auxiliary pressure reading can be specified.	0 to 10000 ms	30 ms
0x06	Sensor temperature source*1	-	Select how to set the self-heating temperature.	<p>0: By communication (EtherCAT or Loader)*2</p> <p>1: By DI*3</p> <p>Other: (disabled)</p>	0: By communication (EtherCAT or Loader)
0x07	DI function*4	-	Select the DI function.	<p>0: DI1: AZO, DI2/DI3: SP, DI4: LPF</p> <p>1: DI1: AZO, DI2/DI3/DI4: SP</p> <p>2: Without the DI function</p> <p>Other: (disabled)</p>	0: DI1: AZO, DI2/DI3: SP, DI4: LPF

*1. The setting is available only for models with variable self-heating temperature.

*2. The value set in 0x5001.0x09 is valid as the self-heating temperature setting.

*3.  *User's Manual for Smart Loader Package Model SLP-V8 for Sapphire Capacitance Diaphragm Gauge Model V8, CP-SP-1472E.*

*4. The selectable DI function and the default setting differ depending on the model number. For details on the DI function and the relationship between the function and model numbers, refer to the  *Sapphire Capacitance Diaphragm Gauge Integrated Model V8C User's Manual (CP-UM-5998JE)* and  *Sapphire Capacitance Diaphragm Gauge Separated Model V8S User's Manual (CP-UM-5999JE).*

■ Input Area (0x6000–0x6FFF)

Index	Object Code/SI	Data type	Access	rx/tx, nv	Name
6000	RECORD	Input Common			
	0x0D	BOOL	RO	tx	New message in the diagnosis history
	0x0E	BOOL	RO	tx	TxPDO state (0: invalid, 1: valid)
	0x0F	BIT2	RO	tx	Input cycle counter
	0x11	REAL	RO	tx	Sensor value
6001	RECORD	Input Capacitance Diaphragm			
	0x01	BOOL	RO	tx	Reading valid*1 (0: invalid, 1: valid)
	0x02	BOOL	RO	tx	Overrange exceeded (0: not exceeded, 1: exceeded)
	0x03	BOOL	RO	tx	Underrange exceeded (0: not exceeded, 1: exceeded)
600E	RECORD	Input Trip Point 1			
	0x01	BOOL	RO	tx	Status High Trip (0: not assert, 1: assert)
	0x02	BOOL	RO	tx	Status Low Trip (0: not assert, 1: assert)
	0x03	BOOL	RO	tx	Output value high trip
	0x04	BOOL	RO	tx	Output value low trip
600F	RECORD	Input Trip Point 2			
	0x01	BOOL	RO	tx	Status High Trip (0: not assert, 1: assert)
	0x02	BOOL	RO	tx	Status Low Trip (0: not assert, 1: assert)
	0x03	BOOL	RO	tx	Output value high trip
	0x04	BOOL	RO	tx	Output value low trip

*1. The reading is valid if all of the following conditions are met:

- No error or alarm has occurred.
- The sensor value is within the accuracy-guaranteed range.
- The self-heating temperature is ± 1 °C of the setting (this condition applies only to models with self-heating function)

■ Output Area (0x7000–0x7FFF)

Index	Object Code/SI	Data type	Access	rx/tx, nv	Name
7000	RECORD	Output Common			
	0x0F	BIT2	RW	rx	Output cycle counter

■ Configuration Area (0x8000–0x8FFF)

Index	Object Code/SI	Data type	Access	rx/tx, nv	Name
8001	RECORD	Configuration Capacitance Diaphragm			
	0x11	REAL	RW	nv	Sensor Temperature Select (°C)*1
	0x12	REAL	RW	nv	OCS: Offset Customer Specific
	0x13	REAL	RW	nv	GCS: Gain Customer Specific
800E	RECORD	Configuration Trip Point 1			
	0x01	BOOL	RW	nv	High Trip Enable (default: disabled)
	0x02	BOOL	RW	nv	Low Trip Enable (default: enabled)
	0x03	BOOL	RW	nv	Polarity (status: default)
	0x04	BOOL	RW	–	Override Enable (default: disabled)
	0x05	BOOL	RW	–	Override High Trip (default: disabled)
	0x06	BOOL	RW	–	Override Low Trip (default: disabled)
	0x11	REAL	RW	nv	High Trip Point Limit*2
	0x14	REAL	RW	nv	Low Trip Point Limit*2
	0x17	REAL	RW	nv	High Trip Hysteresis*2
	0x18	REAL	RW	nv	Low Trip Hysteresis*2
800F	RECORD	Configuration Trip Point 2			
	0x01	BOOL	RW	nv	High Trip Enable (default: disabled)
	0x02	BOOL	RW	nv	Low Trip Enable (default: enabled)
	0x03	BOOL	RW	nv	Polarity (status: default)
	0x04	BOOL	RW	–	Override Enable (default: disabled)
	0x05	BOOL	RW	–	Override High Trip (default: disabled)
	0x06	BOOL	RW	–	Override Low Trip (default: disabled)
	0x11	REAL	RW	nv	High Trip Point Limit*2
	0x14	REAL	RW	nv	Low Trip Point Limit*2
	0x17	REAL	RW	nv	High Trip Hysteresis*2
	0x18	REAL	RW	nv	Low Trip Hysteresis*2

*1. The setting is available only for models with variable self-heating temperature.

*2. A warning will be issued if an invalid parameter value was specified.



Valid parameter conditions

High Trip Point Limit \geq Low Trip Point Limit

Low Trip Point Limit + Low Trip Hysteresis \leq High Trip Point Limit – High Trip Hysteresis



High Trip Hysteresis \geq 0

Low Trip Hysteresis \geq 0

The default Trip Point settings can be specified by the 9th to 14th digits of the model number.  *Sapphire Capacitance Diaphragm Gauge Integrated Model V8C User's Manual (CP-UM-5998JE)* and  *Sapphire Capacitance Diaphragm Gauge Separated Model V8S User's Manual (CP-UM-5999JE)*.

● Configuration Capacitance Diaphragm (0x8001)

SI	Name	Unit	Description	Setting range	Default
0x11	Sensor Temperature Select* ¹	°C	Specify the self-heating temperature setting.	* ¹	* ¹
0x12	OCS: Offset Customer Specific* ²	* ³	The offset for the pressure reading can be changed.	–20 to +20 % FS of the pressure range specified for the model	0 % FS of the pressure range specified for the model
0x13	GCS: Gain Customer Specific* ²	–	The gain for pressure reading can be changed.	0.9001 to 1.0999	1.0000

*1. Writing of this setting is allowed only for models with variable self-heating temperature. The setting range and default value are different depending on the model number.  *Sapphire Capacitance Diaphragm Gauge Integrated Model V8C User's Manual (CP-UM-5998JE)* and  *Sapphire Capacitance Diaphragm Gauge Separated Model V8S User's Manual (CP-UM-5999JE)*.

*2. The pressure reading is calculated using the gain and offset values as shown below, based on the value obtained by adding the accumulated zero offset (AZO) to the pre-correction pressure reading.

$$\text{Pressure reading} = \text{pressure gain (GCS)} \times (\text{pre-correction pressure reading} + \text{accumulated zero offset (AZO)}) + \text{pressure offset (OCS)}$$

*3. Unit of pressure set in Data Units (0xF840.0x01).

● Configuration Trip Point 1 (0x800E)

SI	Name	Unit	Description	Setting range	Default
0x01	High Trip Enable	–	Enables or disables the High Trip Point Limit judgment.	False: disabled True: enabled	False: disabled
0x02	Low Trip Enable	–	Enables or disables the Low Trip Point Limit judgment.	False: disabled True: enabled	True: enabled
0x03	Polarity	–	Specify the output polarity.	False: positive True: negative	False: positive
0x04	Override Enable	–	Enables or disables override.	False: disabled True: enabled	False: disabled
0x05	Override High Trip	–	Enables or disables Override High Trip.	False: disabled True: enabled	False: disabled
0x06	Override Low Trip	–	Enables or disables Override Low Trip.	False: disabled True: enabled	False: disabled
0x11	High Trip Point Limit	*	Specifies the High Trip Point Limit.	–10 to +110 % FS of the pressure range specified for the model	+110 % FS of the pressure range specified for the model
0x14	Low Trip Point Limit	*	Specifies the Low Trip Point Limit.	–10 to +110 % FS of the pressure range specified for the model	+50 % FS of the pressure range specified for the model
0x17	High Trip Hysteresis	*	Specifies the High Trip Hysteresis.	0 to +20 % FS of the pressure range specified for the model	+0.5 % FS of the pressure range specified for the model
0x18	Low Trip Hysteresis	*	Specifies the Low Trip Hysteresis.	0 to +20 % FS of the pressure range specified for the model	+0.5 % FS of the pressure range specified for the model

* Unit of pressure set in Data Units (0xF840.0x01).

● Configuration Trip Point 2 (0x800F)

SI	Name	Unit	Description	Setting range	Default
0x01	High Trip Enable	–	Enables or disables the High Trip Point Limit judgment.	False: disabled True: enabled	False: disabled
0x02	Low Trip Enable	–	Enables or disables the Low Trip Point Limit judgment.	False: disabled True: enabled	True: enabled
0x03	Polarity	–	Specify the output polarity.	False: positive True: negative	False: positive
0x04	Override Enable	–	Enables or disables override.	False: disabled True: enabled	False: disabled
0x05	Override High Trip	–	Enables or disables Override High Trip.	False: disabled True: enabled	False: disabled
0x06	Override Low Trip	–	Enables or disables Override Low Trip.	False: disabled True: enabled	False: disabled
0x11	High Trip Point Limit	*	Specifies the High Trip Point Limit.	–10 to +110 % FS of the pressure range specified for the model	+110 % FS of the pressure range specified for the model
0x14	Low Trip Point Limit	*	Specifies the Low Trip Point Limit.	–10 to +110 % FS of the pressure range specified for the model	+50 % FS of the pressure range specified for the model
0x17	High Trip Hysteresis	*	Specifies the High Trip Hysteresis.	0 to +20 % FS of the pressure range specified for the model	+0.5 % FS of the pressure range specified for the model
0x18	Low Trip Hysteresis	*	Specifies the Low Trip Hysteresis.	0 to +20 % FS of the pressure range specified for the model	+0.5 % FS of the pressure range specified for the model

* Unit of pressure set in Data Units (0xF840.0x01).

■ Information Area (0x9000–0x9FFF)

Index	Object Code/SI	Data type	Access	rx/tx, nv	Name
9000	RECORD	Information Common			
	0x01	REAL	RO	nv	Accumulated zero offset
	0x02	REAL	RO	nv	Highest Informational Measurement Value
	0x03	REAL	RO	nv	Highest Precision Measurement Value
	0x04	REAL	RO	nv	Lowest Precision Measurement Value
	0x05	REAL	RO	nv	Lowest Informational Measurement Value
9001	RECORD	Information Capacitance Diaphragm			
	0x01	UINT	RO	–	Sensor Warnings* ¹
	0x02	UINT	RO	–	Sensor Errors* ²
	0x03	REAL	RO	–	Actual Sensor Temperature

*1. 0x9001.01 is the same as 0xF381.01.

*2. 0x9001.02 is the same as 0xF383.01.

■ Device Area (0xF000–0xFAFF)

Index	Object Code/SI	Data type	Access	Value	Name
F000	RECORD	Semiconductor device profile			
	0x01	UINT	RO	0x10	Index distance
	0x02	UINT	RO	1	Maximum number of modules
F010	ARRAY	Module profile list			
	0x01	UDINT	RO	0x0820	SubIndex 001

Index	Object Code/SI	Data type	Access	rx/tx, nv	Name
F380	VAR	USINT	RO	tx	Active exception status*
F381	ARRAY	Active device warning details			
	0x01	UDINT	RO	tx	SubIndex 001
F382	ARRAY	Active Manufacturer Warning Details			
	0x01	UDINT	RO	tx	SubIndex 001
F383	ARRAY	Active Device Error Details			
	0x01	UDINT	RO	tx	SubIndex 001
F384	ARRAY	Active Manufacturer Error Details			
	0x01	UDINT	RO	tx	SubIndex 001
F385	RECODE	Active Global Device Warning Details			
	0x01	UDINT	RO	tx	SubIndex 001
F387	RECODE	Active Global Device Error Details			
	0x01	UDINT	RO	tx	SubIndex 001
F390	VAR	USINT	RO	tx	Latched exception status
F391	ARRAY	Latched Device Warning Details			
	0x01	UDINT	RO	tx	SubIndex 001
F392	ARRAY	Latched Manufacturer Warning Details			
	0x01	UDINT	RO	tx	SubIndex 001
F393	ARRAY	Latched Device Error Details			
	0x01	UDINT	RO	tx	SubIndex 001
F394	ARRAY	Latched Manufacturer Error Details			
	0x01	UDINT	RO	tx	SubIndex 001
F395	RECORD	Latched Global Device Warning Details			
	0x01	UDINT	RO	tx	SubIndex 001
F397	RECORD	Latched Global Device Error Details			
	0x01	UDINT	RO	tx	SubIndex 001
F3A1	ARRAY	Device Warning Mask			
	0x01	UDINT	RW	nv	SubIndex 001
F3A2	ARRAY	Manufacturer Warning Mask			
	0x01	UDINT	RW	nv	SubIndex 001
F3A3	ARRAY	Device Error Mask			
	0x01	UDINT	RW	nv	SubIndex 001
F3A4	ARRAY	Manufacturer Error Mask			
	0x01	UDINT	RW	nv	SubIndex 001
F3A5	RECORD	Global Device Warning Mask (Mask for 0x0F385.01)			
	0x01	UDINT	RW	nv	SubIndex 001
F3A7	RECORD	Global Device Error Mask (Mask for 0x0F387.01)			
	0x01	UDINT	RW	nv	SubIndex 001

* Active Exception Status (see ETG.5003-1):





A summary of active device exceptions after application of the exception mask (0xF3Ax) See the table below for details.

● Active Exception Status (0xF380.0x01)

Bit	Description	Value
Bits 4–7	Reserved	0
Bit 3	Manufacturer error	Bit 3 = F384.0x01 & F3A4.0x01
Bit 2	Device error	Bit 2 = F383.0x01 & F3A3.0x01 F387.0x01 & F3A7.0x01
Bit 1	Manufacturer warning	Bit 1 = F382.0x01 & F3A2.0x01
Bit 0	Device warning	Bit 0 = F381.0x01 & F3A1.0x01 F385.0x01 & F3A5.0x01

Note: || indicates OR (logical sum) and & indicates AND (logical product).

Details on 0xF38x objects are given below. The following notation is used in the tables below.

Notation	Description	Related section
Enn	Indicates error number nn	 ■ Error (p. 3-1)
Ann	Indicates alarm number nn	 ■ Alarm (p. 3-2)
Wnn	Indicates warning number nn	 ■ Warning (p. 3-2)
Inn	Indicates information number nn	 ■ Info (p. 3-4)

● Active Global Device Warning/Error (0xF385.0x01, 0xF387.0x01)

Bit	ETG.5003.2080 definition	V8 code	
		Warnings (0xF385)	Errors (0xF387)
Bits 16–31	Reserved	–	–
Bit 15	Reserved	–	–
Bit 14	Reset exception	W15	–
Bit 13	Notify vendor	–	–
Bit 12	Scheduled maintenance due	W09	–
Bit 11	Power supply input voltage	W16	E16
Bit 10	Power supply output voltage	–	–
Bit 9	Reserved	–	–
Bit 8	Power supply overcurrent	–	–
Bit 7	Reserved	–	–
Bit 6	Internal real time exception	–	–
Bit 5	Reserved	–	–
Bit 4	RAM exception	–	E26
Bit 3	EEPROM exception	–	E27
Bit 2	EPR0M exception	–	E28
Bit 1	μP exception	–	E31
Bit 0	Internal diag	–	E30

● Active Device Warning (0xF381.0x01)

Bit	ETG.5003.2080 definition	V8 code
Bits 2–31	Reserved	–
Bit 1	Electronics warning	–
Bit 0	Reserved	–

● Active Device Error (0xF383.0x01)

Bit	ETG.5003.2080 definition	V8 code
Bit 31	Configuration exception	A01
Bits 3–30	Reserved	–
Bit 2	Electronics over-temperature	E19
Bit 1	Electronics failure	E25
Bit 0	Diaphragm failure	E24

■ Manufacturer Error/Warning (0xF384.0x01, 0xF382.0x01)

Bit	ETG.5003.2080 definition	V8 code	
		0xF384.0x01	0xF382.0x01
Bit 31	CPU exception error	E31	–
Bit 30	Run-time error	E30	–
Bit 29	Initializing error	E29	–
Bit 28	Program ROM	E28	–
Bit 27	Parameter NVRAM	E27	–
Bit 26	RAM	E26	–
Bit 25	AD converted value	E25	W25
Bit 24	Diaphragm	E24	–
Bit 23	(Undefined)	–	–
Bit 22	EtherCat alarm (error at startup)	A22	–
Bit 21	(Undefined)	–	–
Bit 20	(Undefined)	–	–
Bit 19	Circuit temperature	E19	–
Bit 18	Sensor temperature	E18	–
Bit 17	Heater temperature	E17	–
Bit 16	Supply voltage	E16	–
Bit 15	Watchdog timeout	–	W15
Bit 14	(Mode timeout)	–	–
Bit 13	Model/calibration parameter	E13/A13	W13
Bit 12	Heater disconnection/overcurrent	E12/A12	–
Bit 11	(Undefined)	–	–
Bit 10	(Undefined)	–	–
Bit 9	(Maintenance due time elapsed)	–	–
Bit 8	Automatic cancellation of forced output	–	–
Bit 7	Cycle time	–	W07
Bit 6	Heater temperature control	A06	W06
Bit 5	Auxiliary pressure	–	W05
Bit 4	Pressure	–	W04
Bit 3	Parameter write count	–	W03
Bit 2	FRAM access	–	W02
Bit 1	User parameter	A01	W01
Bit 0	Zero adjustment	–	W00

● CDP Device Specific Inputs

Index	Object Code/SI	Data type	Access	rx/tx, nv	Name
F641	RECORD	Trip Point Output All			
	0x01	UDINT	RO	tx	Trip Point Output All Instance*1
F6F0	ARRAY	Input Latch Local Timestamp			
	0x01	UDINT	RO	tx	SubIndex 001
F6F2	ARRAY	Input Latch ESC Timestamp (64 bits)			
	0x01	ULINT	RO	tx	SubIndex 001
F840	RECORD	Configuration Device			
	0x01	UDINT	RW	nv	Data Units (default): 0x00220000 (Pa)*2 Pa/kPa/bar/mbar, etc.

*1. For details, see the following table.

*2. For the data Unit, see ETG.1004 Unit Specification. The default value is 0x00220000 = Pa.

The value written to the Data Units object will not be valid immediately.

To make the new Data Units setting valid, execute the Store Parameters Command (0xFBF2).

Unit of pressure	Setting
Pa	0x00220000
kPa	0x03220000
bar	0x004e0000
mbar	0xfd4e0000
× 133.322Pa	0x00a10000
× 0.133322Pa	0xfda10000

● F641 (Trip Point Output All Instance) details

Bit	Name	Description
Bits 31–8	Unused	–
Bit 7	Low Trip 4 Status	TP4 Status (related index: 0x4002 object)*
Bit 6	High Trip 4 Status	TP4 Status (related index: 0x4002 object)*
Bit 5	Low Trip 3 Status	TP3 Status (related index: 0x4001 object)*
Bit 4	High Trip 3 Status	TP3 Status (related index: 0x4001 object)*
Bit 3	Low Trip 2 Status	TP2 Status (Index: 0x600F SI: 0x02)
Bit 2	High Trip 2 Status	TP2 Status (Index: 0x600F SI: 0x01)
Bit 1	Low Trip 1 Status	TP1 Status (Index: 0x600E SI: 0x02)
Bit 0	High Trip 1 Status	TP1 Status (Index: 0x600E SI: 0x01)

* Valid only when EU3/EU4 is set as a trip point.

● CDP Device-Specific Information Data

Index	Object Code/SI	Data type	Access	rx/tx, nv	Value	Name
F940	RECORD	Information Device				
	0x01	UDINT	RO	-	1	Measurement principle
	0x02	USINT	RO	-	1	Number of sensors
F9F0	VAR	STRING (16)	RO	-	-	Manufacturer serial number
F9F1	ARRAY	CDP Functional Generation Number				
	0x01	UDINT	RO	-	2	SubIndex 001
F9F2	ARRAY	SDP Functional Generation Number				
	0x01	UDINT	RO	-	2	SubIndex 001
F9F3	VAR	STRING (16)	RO	-	*1	Vendor name
F9F4	ARRAY	Semiconductor SDP Device Name				
	0x01	STRING (16)	RO	-	"VG"	SubIndex 001
F9F5	ARRAY	Output Identifier				
	0x01	USINT	RW	rx/tx	-	SubIndex 001
F9F6	VAR	UDINT	RO	-	-	Time since power-on
F9F7	VAR	UDINT	RO	-	-	Total time powered
F9F8	VAR	UDINT	RO	-	1	Firmware update functional generation number*2

*1. Azbil Corporation

*2. Firmware update is supported, but it is not a public function.

■ Device Command (0xFB00–0xFBFF)

Index	Object Code/SI	Data type	Access	tx/rx, nv	Name
FB40	RECORD	Zero Adjust Command			
	0x01	ARRAY [0–5] OF BYTE	RW	–	Command*
	0x02	USINT	RO	–	Status
	0x03	ARRAY [0–2] OF BYTE	RO	–	Response
FBF0	RECORD	Device Reset Command			
	0x01	ARRAY [0–5] OF BYTE	RW	–	Command Byte [0]: 0x74 Byte [1]: 0x65 Byte [2]: 0x73 Byte [3]: 0x65 Byte [4]: 0x72 Byte [5]: Standard Reset 0x00 Factory Reset 0x66 is not supported.
	0x02	USINT	RO	–	Status
	0x03	ARRAY [0–1] OF BYTE	RO	–	Response [0]: See Subindex 2 [1]: Unused – Shall be zero
FBF1	RECORD	Exception Reset Command			
	0x01	ARRAY [0–4] OF BYTE	RW	–	Command Byte [0]: 0x74 Byte [1]: 0x65 Byte [2]: 0x73 Byte [3]: 0x65 Byte [4]: 0x72
	0x02	USINT	RO	–	Status
	0x03	ARRAY [0–1] OF BYTE	RO	–	Response [0]: See Subindex 2 [1]: Unused – Shall be zero
FBF2	RECORD	Store Parameters Command			
	0x01	ARRAY [0–3] OF BYTE	RW	–	Command Byte [0]: 0x73 Byte [1]: 0x61 Byte [2]: 0x76 Byte [3]: 0x65
	0x02	USINT	RO	–	Status
	0x03	ARRAY [0–1] OF BYTE	RO	–	Response

Index	Object Code/Sl	Data type	Access	tx/rx, nv	Name
FBF3	RECORD	Calculate Checksum Command			
	0x01	ARRAY [0–3] OF BYTE	RW	–	Command Read: byte [0]: 0x81 Write: byte [0]: 0x01 Byte [1–3]: Shall be zero Write bit 0: Use default checksum algorithm of the slave.
	0x02	USINT	RO	–	Status
	0x03	ARRAY [0–9] OF BYTE	RO	–	Response (10 bytes) [0]: Status [1]: Unused – Shall be zero [2–9]: Checksum (8 bytes)
FBF4	RECORD	Load Parameter Command			
	0x01	ARRAY [0–3] OF BYTE	RW	–	Command: Byte [0]: 0x6C Byte [1]: 0x6F Byte [2]: 0x61 Byte [3]: 0x64
	0x02	USINT	RO	–	Status
	0x03	ARRAY [0–1] OF BYTE	RO	–	Response (2 bytes) [0]: See Subindex 2 [1]: Unused – Shall be zero

See the following sections for details on the FB40 and FBF2 commands.

For the function of other commands, refer to ETG.5003-1 and ETG.5003-2080.

● **Zero adjustment command (FB40)**

Description of command byte [0] value:

Value	Function	Description
0	Zero adjustment without specified offset	Zero calibration is executed and pressure value 0 will be output.
1	Zero adjustment with offset of 0	Zero calibration is executed and pressure value 0 will be output (the same result as above).
2	Zero adjustment with specified offset	Zero calibration is executed and a pressure value with the specified offset will be output.

Explanation of value of command byte [1]: Write “1.”

Explanation of value of command bytes [2–5]: Offset value (data format: REAL)

The results of adjustment with the setting “0” (zero adjustment without specified offset) and “1” (zero adjustment with offset of 0) will be the same and pressure value 0 will be output.

The following response will be returned.

Value of SI=2	Description	SI=3 (response)	Description
0	No errors, no reply available	254 (= no previous Zero Adjust command issued)	After power-on, an attempt to read was made, but there was no previous Zero Adjust command.*3
1	No errors, reply available	0 (= command resp. successful); AZO < ± 20 % FS*1	Zero point adjustment is completed.
2	(Unsupported value) Error occurred, no reply available	(Unsupported response)	This state does not occur.
3	Error occurred, reply available	2 (= failed, cumulative Out Of Range); AZO $\geq \pm 20$ % FS	The zero point was not adjusted because AZO $\geq \pm 20$ % FS.
		3 (= failed, measurement invalid)	The zero point was not adjusted because the pressure reading is invalid.
255	Executing	0 (= command resp. successful)*2	Zero point adjustment is in progress.

*1. When SI: 0x02 = 1, SI: 0x03 is always 0.

*2. When SI: 0x02 = 255, SI: 0x03 is always 0.

*3. After power-on, the device will always be in a state where no Zero Adjust command has been executed.

Note 1: FB40 execution time is 1 s or shorter.

Note 2: The value of SI: 0x02 (status) changes to 255 (executing) immediately after the command (SI: 0x01) is written.

Then, when zero point adjustment is completed, it will change to a value indicating the result of adjustment (normal or abnormal).

■ Zero point adjustment process

The process of zero point adjustment using the Zero Adjust command (FB40) is shown below.

- (1) Issue a command (SI: 0x01) to request zero point adjustment.
- (2) Read the status (SI: 0x02) and wait until the zero point adjustment is completed.
- (3) Read the response (SI: 0x03) to check the result of zero point adjustment.

■ Zero Adjust command operation

When the EtherCAT Zero Adjust command (FB40) is issued with the setting “0” (zero adjustment without specified offset), the AZO value is rewritten so that pre-compensation pressure + AZO = zero, regardless of the OCS value.

When the setting is “1” (zero adjustment with offset of 0), the operation is the same as with setting “0” (zero adjustment without offset).

When the setting is “2” (zero adjustment with specified offset), the AZO value is rewritten so that so that pre-compensation pressure + AZO = the specified offset value.

Specify the zero point adjustment method using byte 0 of SI 0x01.

Specify the offset value using bytes 2–5 of SI 0x01.

Examples of Zero Adjust command (FB40) results are shown below.

- Zero adjustment without specified offset (OCS = 0 before execution)

Status	Pre-compensation pressure	GCS	OCS	AZO	Pre-compensation pressure + AZO	Pressure reading
Before command execution	23	1	0	-2	21	21
After command execution	23	1	0	-23	0	0

- Zero adjustment without specified offset (OCS = 5 before execution)

Status	Pre-compensation pressure	GCS	OCS	AZO	Pre-compensation pressure + AZO	Pressure reading
Before command execution	23	1	5	-2	21	26
After command execution	23	1	5	-23	0	5

- Zero adjustment with specified offset (OCS = 0 before execution)

When specified offset = 7

Status	Pre-compensation pressure	GCS	OCS	AZO	Pre-compensation pressure + AZO	Pressure reading
Before command execution	23	1	0	-2	21	21
After command execution	23	1	0	-16	7	7

- Zero adjustment with specified offset (OCS = 5 before execution)

When specified offset = 7

Status	Pre-compensation pressure	GCS	OCS	AZO	Pre-compensation pressure + AZO	Pressure reading
Before command execution	23	1	5	-2	21	26
After command execution	23	1	5	-16	7	12

● FBF2 (Store Parameters Command)

This command writes the value of the nv-specified object to nonvolatile memory.

If the value of the nv-specified object has been changed, and if the power is turned off without executing this command, the object retains its previous value.

■ Diagnosis History

The 0x10F3 object complies with the Diagnosis History Object that is specified in section 14, "Diagnosis Handling," of *EtherCAT Protocol Enhancements* (ETG.1020 S (R) V1.3.0) .

Note that only the Overwrite mode is supported. The Acknowledge mode is not supported.

● Object details

0x10F3 details

SI	Name	Access	Value	Note
1	Maximum messages	R	32	–
2	Newest message	R	0	Initial value
3	Newest acknowledged message	RW	0	Initial value* ¹
4	Newest message available	R	0	Depends on NVRAM history data
5	Flags	RW	0x00	Only bits 1, 2, and 3 are writable.
6–37	Diagnosis messages	R	–	32 max.

*1. The value cannot be changed.

Parameter details

Parameter	Description	
DiagCode	Diagnosis code to identify the diagnosis message	
	Bits 0–15 = 0x0000-0xDFFF	Not used
	Bits 0–15 = 0xE000-0xE7FF	Azbil-specific code (see the following section)
	Bits 0–15 = 0xE802	Module related messages (incl. module number assignment) Bits 16–23: Module No, 1 = 1'st module Bits 24–31: 0x00 See the Semi Device Profile, Appendix B
	Bits 0–15 = Other	Not used
Flags	Bits 0–3	Diag type
	Bit 4 = 0	Not used
	Bits 5–7 = 0	Reserved for future standardization
	Bits 8–15 = 0	Number of parameters in this diagnosis message (no parameters)
Text ID	0	No text ID
Time Stamp	<>0	Azbil-specific timestamp (see the following section)

● Azbil-specific diagnosis code

Value	Exception	Note
0x0000e000	Auto zero adjustment	–
0x0000e802	User parameter	–
0x0002e000	FRAM access error	–
0x0003e000	FLASH write times over	–
0x0004e000	Pressure range over	–
0x0005e000	Aux. pressure range over	–
0x0006e000	Heater control	–
0x0007e000	Cycle timeout	–
0x0008e000	Forced timeout	–
0x0009e000	Maintenance due time	–
0x000ae000	(reserved)	–
0x000be000	(reserved)	–
0x000ce000	Heater broken	–
0x0000e802	Internal parameter	–
0x000ee000	System timeout	–
0x0000e802	Watch dog timeout	–
0x0010e000	Input power voltage error	–
0x0011e000	Heater temperature	–
0x0012e000	Sensor temperature	–
0x0000e802	Circuit board temperature	–
0x0014e000	(reserved)	–
0x0015e000	(reserved)	–
0x0016e000	EtherCAT error	–
0x0017e000	(reserved)	–
0x0000e802	Diaphragm	–
0x0019e000	AD converter error	–
0x001ae000	RAM error	–
0x0000e802	EEPROM error	–
0x001ce000	ROM checksum error	–
0x0000e802	Initialization error	–
0x001ee000	Run-time error	–
0x0000e802	CPU exception	–

! Handling Precautions

- The diagnosis history is reset when the EtherCAT state transitions from INIT to any other state.
- The diagnosis history is not retained if a power failure occurs. The history is reset when the power is turned back on.

■ Other

● Complete Access

Writing by SDO Complete Access is not supported for the objects below. If attempted, an Unsupported Access error will be returned.

Index	Description
4000	Analog Output Configuration
4001	Event 3 Configuration
4002	Event 4 Configuration
4003	Misc. Configuration
8001	Configuration Common
800E	Configuration Trip Point 1
800F	Configuration Trip Point 2
F840	Configuration Device
F3A1	Capacitance Diaphragm Warning Mask
F3A2	Active Manufacturer Warning Mask
F3A3	Capacitance Diaphragm Error Mask
F3A4	Active Manufacturer Error Mask
F3A5	Global Device Warning Mask
F3A7	Global Device Error Mask

● Manual operation

If a manual operation (for example, manually initiated automatic zero adjustment) is performed during execution of an EtherCAT command, the result of the operation might be abnormal, depending on the timing of the operation.

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Chapter 3. Exception Status

There are three types of exception status: error, alarm, and warning.

Exception category	Description
Error	There may be a problem with the product. It may be necessary to replace the device.
Alarm	The operating conditions exceeded the specifications, possibly affecting device performance. It is necessary to check the operating conditions.
Warning	The operating conditions exceeded the specifications, but performance will not be affected immediately.

The status may return to normal automatically, depending on the nature of the problem. For problems that require manual operation in order to return to normal status after the abnormality (error or alarm) is resolved, restart the product or reset the exception status.

■ Error

Details on errors are given below.

Code	Item	Conditions for detection	Notes
E02	FRAM (nonvolatile memory)	FRAM error	Abnormal FRAM initialization (there is a high probability of some kind of hardware problem). Settings such as user parameters are not stored in the FRAM. Nonvolatile data (e.g., abnormality history, operating time) other than parameters is stored.
E12	Heater disconnection/overcurrent	A problem with the heater	–
E13	Model/calibration parameter alarm	Invalid value	Device-specific internal parameter
E16	Power voltage	Limit exceeded	–
E17	Heater temperature	Limit exceeded	–
E18	Gauge head temperature	Limit exceeded	–
E19	Circuit temperature	Limit exceeded	–
E24	Diaphragm	Diaphragm damage or disconnection	–
E25	AD converted value	The AD converted value is out of range.	–
E26	RAM	Access error, detected only at startup	–
E27	Parameter NVRAM	Checksum error or incorrect setting	–
E28	Program ROM	Checksum error, detected only at startup	–
E29	Initialization error	Initialization execution error, detected only at startup	–
E30	Run-time error	An unexpected condition occurred while the program was running.	–
E31	CPU exception error	An exception occurred while the CPU was running.	–

■ Alarm

Details on alarms are given below.

Code	Item	Conditions for detection	Notes
A01	User parameter	User parameter setting error (e.g., invalid EV3/EV4 value)	Invalid values were set for user parameters (e.g., invalid EV3/EV4 value) This alarm is usually caused by a problem during use of the Smart Loader Package. * EV3: The default setting is "Outputs warm-up status." EV4: The default setting is "Outputs error or alarm status."
A06	Heater temperature control	Out-of-range control temperature continued for longer than the time allowed.	Normal control temperature range: the self-heating temperature ± 1 °C was maintained for more than 5 minutes This alarm is issued when: <ul style="list-style-type: none"> • After power-on, the temperature did not enter the normal control temperature range within 90 minutes • The temperature entered the normal control temperature range but then went out of the range for 10 minutes or longer.
A12	Heater disconnection/overcurrent	A problem with the heater	–
A13	Model/calibration parameter alarm	Invalid value	Device-specific internal parameter
A22	EtherCAT	EtherCAT LSI initialization error, etc.	Detected only at startup

■ Warning

Details on warnings are given below.

Code	Item	Conditions for detection	Notes
W00	Zero adjustment	An error was detected in the internal processing during zero adjustment.	–
W01	User parameter	Invalid value*	User parameter settings are invalid. Ex.: Low Trip Limit > High Trip Limit
W02	FRAM access	FRAM access failed.	A probably recoverable FRAM access error. If this warning occurs, the STATE LED blinks but the other LEDs (EV, etc.) do not blink and normal operation continues. A temporary factor such as electrical noise can cause this warning, so operation will be normal unless the warning continues.
W03	Parameter write count	Parameters were written more than 30,000 times.	This warning is issued when user parameters are written more than 30,000 times. Normal operation continues even if the designed maximum write count is exceeded.

Code	Item	Conditions for detection	Notes
W04	Pressure	The pressure is outside the accuracy-guaranteed range. Note that this warning will not be issued immediately if the pressure exceeds the accuracy-guaranteed range during power-on. After power-on, if the pressure enters the allowable range and then exceeds it again, this warning will be issued.	0–100 % FS of the pressure range
W05	Auxiliary pressure alarm	Auxiliary pressure is out of range.	Auxiliary pressure: A reference value that is measured using capacitance of the compensating sensor for a wider range than the pressure range specified for the model, and its accuracy is not specified.
W06	Heater temperature control	The temperature is outside the control temperature range.	The temperature entered the normal control temperature range but now has been out of range for less than 10 minutes. Normal control temperature range: the specified temperature ± 1 °C was maintained for more than 5 minutes
W09	Maintenance due time	Maintenance due time elapsed	–
W15	Watchdog time-out	Application time-out occurred.	If this warning is issued, the product will automatically restart.
W16	Supply voltage	Allowed value exceeded	–
W17	Heater temperature	Allowed value exceeded	–
W18	Gauge head temperature	Allowed value exceeded	–
W19	Circuit temperature	Allowed value exceeded	–
W25	AD converted value	The AD converted value is out of range.	–
W29	Initialization error	Detected for EtherCAT	–

* User parameter settings that meet all of the following conditions are valid.

Valid parameter conditions*
$\#TPn_HITRIP_LMT \geq \#TPn_LOTRIP_LMT$
$\#TPn_LOTRIP_LMT + \#TPn_LOTRIP_HYST \leq \#TPn_HITRIP_LMT - \#TPn_HITRIP_HYST$
$\#TPn_HITRIP_HYST \geq 0$
$\#TPn_LOTRIP_HYST \geq 0$

* \geq means above and \leq means below.

Regardless of whether High Trip Enable and Low Trip Enable are enabled or disabled, these conditions must be satisfied.

The following notation is used in the table above.

TPn means trip point n. (n = 1, 2, 3, or 4)

Notation	Description
$\#TPn_HITRIP_LMT$	High Trip Point Limit for TPn
$\#TPn_LOTRIP_LMT$	Low Trip Point Limit for TPn
$\#TPn_HITRIP_HYST$	High Trip Point Hysteresis for TPn
$\#TPn_LOTRIP_HYST$	Low Trip Point Hysteresis for TPn

■ Info

Code	Item	Conditions for detection	Notes
I14	Mode time-out (Fixed at 3 minutes)	Automatic zero point adjustment time-out, etc.	Time-out that occurs during internal processing Ex.: Parameters must be locked by the loader when accessed, and timeout will occur if they are locked for longer than a certain period of time. It does not indicate a problem with the device.

 Handling Precautions

- The status of event output and 0–10 V output may become unreliable if any of the following exceptions occurs.
 A01: User parameter
 A13: Model/calibration parameter alarm
 E28: Program ROM
 E26: RAM
 E29: Initialization error
 E30: Run-time error

Note: If [Function selection] for event output (relay 4) is set to “Outputs error or alarm status,” the relay output may not be correct if any of the above exceptions occur.
 If “Output mode on error” of the analog output setting is set to a value other than the default value, analog output may not be correct if any of the above exceptions occur.

Chapter 4. ESI File

The ESI file for the V8 can be downloaded from the website indicated below (search for V8, “Download product documents,” and “EtherCAT ESI file”).

Compo Club URL: <https://www.compoclub.com/>

EtherCAT ESI file: V8-ESI-rev0x07.xml

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Chapter 5. Troubleshooting

■ Judgment based on the EtherCAT ERROR LED lighting

The type of error in this device can be known from the status of the EtherCAT ERROR LED.

If the problem persists even after taking the following countermeasures, replace this device.

LED	Status	Description	Countermeasures
EtherCAT ERROR LED	ON	EtherCAT communication disabled (WDT or abort occurred)	Turn the power off and back on.
	Double flash	Watchdog time-out occurred in EtherCAT communications.	Check for any abnormality in the communication path (disconnection of the communication cable or connector). If there is a problem, correct it.
	Single flash	An operational error occurred in EtherCAT communications.	Check for a problem with the EtherCAT master and eliminate the cause.
	Flickering	Startup error	
	Blinking	Setting error	

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Appendix

■ Reference materials

Document	Description	Version
ETG.1000.2	<i>Physical Layer Service Definition and Protocol Specification</i>	–
ETG.1000.3	<i>Data Link Layer Service Definition</i>	–
ETG.1000.4	<i>Data Link Layer Protocol Definition</i>	–
ETG.1000.5	<i>Application Layer Service Definition</i>	–
ETG.1000.6	<i>Application Link Layer Protocol Definition</i>	–
ETG.1020	<i>EtherCAT Protocol Enhancement</i>	–
ETG.2000	<i>EtherCAT Slave Information</i>	–
ETG.2100	<i>EtherCAT Network Information</i>	–
ETG.5001.1	<i>Module Device Profile — Part 1: General MDP Device Model</i>	–
ETG.5001.2	<i>Module Device Profile — Part 2: MDP Module Device Specification</i>	–
ETG.5003-1	<i>Semiconductor Device Profile — Part 1: Common Device Profile</i>	V1.1.0
ETG.5003-2080	<i>Semiconductor Device Profile — Part 2080: Specific Device Profile: Vacuum Pressure Gauge</i>	V1.3.0 1.5.0 (OD)
IEC 61158-x-12	<i>Industrial Communication Networks — Fieldbus Specifications</i>	–
IEC 61784-2	<i>Industrial Communication Networks — Profiles — Part 2: Additional Fieldbus Profiles for Real-Time Networks Based on ISO/IEC 8802-3</i>	–

ETG series documents give the specifications for EtherCAT technology that have been issued by the EtherCAT Technology Group.

For the documents with no indication of version, refer to the latest documents.

■ EtherCAT terms

Term	Expanded Term	Description
ESI	EtherCAT Slave Information	Slave device information
SII	Slave Information Interface	Slave device basic information
PDO	Process Data Objects	Cyclic data
TxPDO	Transmit PDO	Cyclic data that a master device reads out from a slave device
RxPDO	Receive PDO	Cyclic data that a master device writes to a slave device
CoE	CAN application protocol over EtherCAT	The CAN protocol over EtherCAT
SDO	Service Data Objects	Objects for data exchange between master and slave
ESC	EtherCAT Slave Controller	EtherCAT slave device
ENI	EtherCAT Network Information	EtherCAT network information
CDP	Common Device Profile	Common device profile
SDP	Specific Device Profile	Specific device profile
MDP	Modular Device Profile	Modular device profile

Term	Description
Master	Controls communication (data input and output) with connected slaves.
Slave	Receives data that is output from the master and transmits data to the master.
Device ID	An identifier for identifying units connected to the EtherCAT network

Revision History of CP-SP-1471E

Date	Rev.	(New) Page No.	Description
Dec. 2022	1		

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Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products.

You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

1.1 Warranty period

Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

1.2 Warranty scope

In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place. Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

- (1) Failure caused by your improper use of azbil product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
- (2) Failure caused for other reasons than Azbil Corporation's product;
- (3) Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;
- (4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;
- (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or
- (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

- (1) Regulations and standards or laws that your Equipment is to comply with.
- (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
- (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use

Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with safety design such as fool-proof design,*1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,*3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

*1. A design that is safe even if the user makes an error.

*2. A design that is safe even if the device fails.

*3. Avoidance of device failure by using highly reliable components, etc.

*4. The use of redundancy.

3. Precautions and restrictions on application

3.1 Restrictions on application

Please follow the table below for use in nuclear power or radiation-related equipment.

	Nuclear power quality*5 required	Nuclear power quality*5 not required
Within a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Cannot be used (except for limit switches for nuclear power*7)
Outside a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Can be used

*5. Nuclear power quality: compliance with JEAG 4121 required

*6. Radiation controlled area: an area governed by the requirements of article 3 of "Rules on the Prevention of Harm from Ionizing Radiation," article 2 2 4 of "Regulations on Installation and Operation of Nuclear Reactors for Practical Power Generation," article 4 of "Determining the Quantity, etc., of Radiation-Emitting Isotopes," etc.

*7. Limit switch for nuclear power: a limit switch designed, manufactured and sold according to IEEE 382 and JEAG 4121.

Any Azbil Corporation's products shall not be used for/with medical equipment.

The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product. However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

3.2 Precautions on application

you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below. Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

- (1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
- (2) For use of specific purposes, such as:
 - * Nuclear energy/radiation related facilities
[When used outside a radiation controlled area and where nuclear power quality is not required]
[When the limit switch for nuclear power is used]
 - * Machinery or equipment for space/sea bottom
 - * Transportation equipment
[Railway, aircraft, vessels, vehicle equipment, etc.]
 - * Antidisaster/crime-prevention equipment
 - * Burning appliances
 - * Electrothermal equipment
 - * Amusement facilities
 - * Facilities/applications associated directly with billing
- (3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
- (4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
- (5) Machinery or equipment that may affect human lives, human bodies or properties
- (6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety

4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations.

In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. After manufacturing is discontinued, we may not be able to provide replacement products even within the warranty period.

For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

- (1) Installation, adjustment, guidance, and attendance at a test run
- (2) Maintenance, inspection, adjustment, and repair
- (3) Technical guidance and technical education
- (4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.

azbil

Specifications are subject to change without notice. (11)

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