



Smartline Vacuum Transmitter EtherCAT Communication Manual



VSR/VCR/VSP/VCP/VSL/VCL



VSM/VS1



VSH

Version: 2.0

Release: May 26, 2025

Copyright: © 2025 Thyracont Vacuum Instruments GmbH

Content

1	Communication	3
1.1	Communication Types.....	3
1.2	Process Data Objects (PDOs).....	3
1.3	CANopen over EtherCAT (CoE).....	3
1.4	Data Exchange with Smartline Transmitter Slaves.....	3
1.4.1	Cyclic Data.....	3
1.4.2	Acyclic Data.....	3
2	Process Data Objects (PDOs)	4
2.1	PDO List.....	4
2.2	TxPDO Content (0x1A00) – Pressure Status.....	4
2.3	TxPDO Content (0x1A01) – Status and Type.....	5
2.4	TxPDO Content (0x1A02) – Transmitter Status.....	7
2.5	TxPDO Content (0x1A03) – Syntax.....	9
2.6	RxPDO Content (0x1600) – Outputs.....	11
3	Commands (0x300F:04).....	13
3.1	Command List.....	13
3.2	General Commands for all Smartline Transmitter	14
3.2.1	0x00 (0) – Zero Command.....	14
3.2.2	0x01 (1) – Adjust High Vacuum.....	14
3.2.3	0x02 (2) – Adjust Atmospheric Pressure.....	14
3.2.4	0x03 (3) – Set Gas Correction Factors.....	14
3.3	VSR/VCR Commands	15
3.3.1	0x39 (57) – Set Sensor Switch Mode	15
3.4	VSL/VCL Commands	15
3.4.1	0x04 (4) – Adjust Relative Pressure	15
3.4.2	0x39 (57) – Set Sensor Switch Mode	15
3.5	VSM/VSJ Commands	15
3.5.1	0x46 (70) – Activate Cold Cathode.....	15
3.5.2	0x47 (71) – Deactivate Cold Cathode.....	15
3.6	VSM Commands	15
3.6.1	0x4D (77) – Set Sensor Switch Mode	15
3.7	VSH Commands.....	16
3.7.1	0x50 (80) – Activate Hot Cathode.....	16
3.7.2	0x51 (81) – Deactivate Hot Cathode.....	16
3.7.3	0x55 (85) – Activate DeGas	16
3.7.4	0x56 (86) – Deactivate DeGas.....	16
3.7.5	0x57 (87) – Set Sensor Switch Mode	16
4	Acyclic Data Exchange.....	17
4.1.1	Firmware Update (0x4000).....	17
4.1.2	Communication Protocol V2 (0x400F).....	17
5	Additional Files (ESI, Documentation).....	18
6	Document History.....	18
7	License	19

1 Communication

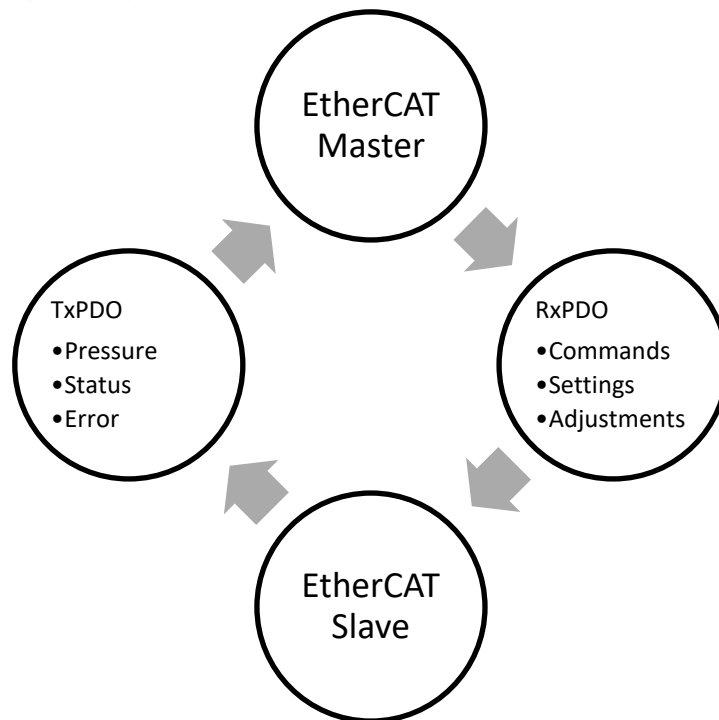
1.1 Communication Types

All Smartline Transmitter support the following communication type:

- Process Data Communication (PDO)

1.2 Process Data Objects (PDOs)

Process Data Objects (PDOs) are used to transfer data with a cyclic communication between slave and master. Reception PDOs (RxPDOs) are used to receive data, and transmission PDOs (TxPDOs) transmit data.



1.3 CANopen over EtherCAT (CoE)

The Object Dictionary can be accessed online by a master via acyclic SDO services, or offline from the ESI file. Both master and slave need to exchange data cyclically. For this reason, CoE protocol allows to configure a specific subset of the objects defined in the Object Dictionary as Process Data. These are provided by the slave and exchanged on a preferred cyclic channel. The values are copied directly from the EtherCAT frame to the local variable in the slave's firmware and vice-versa, instead of being processed by the mailbox.

1.4 Data Exchange with Smartline Transmitter Slaves

1.4.1 Cyclic Data

The objects with index 0x200F and index 0x300F are defined as Input Data, respectively Output Data. These objects are mapped as Process Data Objects (PDOs) for cyclic data exchange.

1.4.2 Acyclic Data

The objects with index 0x4000 and 0x400F can be accessed acyclically and are used for updating the EtherCAT firmware (0x4000), and enabling the full range of transmitter specific commands (0x400F).

2 Process Data Objects (PDOs)

2.1 PDO List

Index	Bitsize	Bitsize VSL/VCL	Name	Flags
0x1A00	64	96	Pressure Status	mandatory, fixed
0x1A01	8	8	Status and Type	mandatory, fixed
0x1A02	8	8	Transmitter Status	mandatory, fixed
0x1A03	16	16	Syntax	mandatory, fixed
0x1600	80	80	Outputs	mandatory, fixed

2.2 TxPDO Content (0x1A00) – Pressure Status

Index	Index VSL/VCL	Bitsize	Name	Type
0x200F:01	0x200F:01	32	Actual Pressure	REAL
---	0x200F:02	32	Relative Pressure	REAL
0x200F:02	0x200F:03	16	Actual GCF 1	UINT
0x200F:03	0x200F:04	16	Actual GCF 2	UINT

Subindex	Subindex VSL/VCL	Description												
0x01	0x01	Actual Pressure: Contains the actual pressure value. Note: A value of “2E-38” means pressure is below range limit, “2E+38” means pressure is above range limit.												
---	0x02	Relative Pressure: Contains the relative pressure value.												
0x02	0x03	Actual GCF 1: Contains the actual Gas Correction Factor (GCF) for Pirani sensor of all Smartline transmitters.												
<table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSR/VCR VSP/VCP VSL/VCL VSM VSH</td> <td>0x0014 – 0x0320 (20 – 800)</td> <td></td> </tr> <tr> <td>VSI</td> <td>0x0000 (0)</td> <td>Fixed</td> </tr> </tbody> </table>			Type	Data	Description	VSR/VCR VSP/VCP VSL/VCL VSM VSH	0x0014 – 0x0320 (20 – 800)		VSI	0x0000 (0)	Fixed			
Type	Data	Description												
VSR/VCR VSP/VCP VSL/VCL VSM VSH	0x0014 – 0x0320 (20 – 800)													
VSI	0x0000 (0)	Fixed												
0x03	0x04	Actual GCF 2: Contains the actual Gas Correction Factor (GCF) for hot or cold cathode of Smartline transmitters.												
<table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSR/VCR VSP/VCP VSL/VCL</td> <td>0x0000 (0)</td> <td>Fixed</td> </tr> <tr> <td>VSM/VSI</td> <td>0x0014 – 0x0320 (20 – 800)</td> <td>Cold cathode</td> </tr> <tr> <td>VSH</td> <td>0x0014 – 0x0320 (20 – 800)</td> <td>Hot cathode</td> </tr> </tbody> </table>			Type	Data	Description	VSR/VCR VSP/VCP VSL/VCL	0x0000 (0)	Fixed	VSM/VSI	0x0014 – 0x0320 (20 – 800)	Cold cathode	VSH	0x0014 – 0x0320 (20 – 800)	Hot cathode
Type	Data	Description												
VSR/VCR VSP/VCP VSL/VCL	0x0000 (0)	Fixed												
VSM/VSI	0x0014 – 0x0320 (20 – 800)	Cold cathode												
VSH	0x0014 – 0x0320 (20 – 800)	Hot cathode												

2.3 TxPDO Content (0x1A01) – Status and Type

Index	Index VSL/VCL	Bitsize	Name	Type
0x200F:04	0x200F:05	3	Sensor Type	BIT3
0x200F:05	0x200F:06	1	DeGas active	BIT
0x200F:06	0x200F:07	1	High vacuum cathode inactive	BIT
0x200F:07	0x200F:08	1	Spare Filament	BIT
0x200F:08	0x200F:09	2	Sensor Switch Mode	BIT2

Subindex	Subindex VSL/VCL	Description																								
0x04	0x05	Sensor Type: Contains the Smartline Transmitter Type																								
<table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSR/VCR</td> <td>0x1 (1)</td> <td></td> </tr> <tr> <td>VSP</td> <td>0x2 (2)</td> <td></td> </tr> <tr> <td>VSM</td> <td>0x3 (3)</td> <td></td> </tr> <tr> <td>VSH</td> <td>0x4 (4)</td> <td></td> </tr> <tr> <td>VCP</td> <td>0x5 (5)</td> <td></td> </tr> <tr> <td>VSI</td> <td>0x6 (6)</td> <td></td> </tr> <tr> <td>VSL/VCL</td> <td>0x7 (7)</td> <td></td> </tr> </tbody> </table>			Type	Data	Description	VSR/VCR	0x1 (1)		VSP	0x2 (2)		VSM	0x3 (3)		VSH	0x4 (4)		VCP	0x5 (5)		VSI	0x6 (6)		VSL/VCL	0x7 (7)	
Type	Data	Description																								
VSR/VCR	0x1 (1)																									
VSP	0x2 (2)																									
VSM	0x3 (3)																									
VSH	0x4 (4)																									
VCP	0x5 (5)																									
VSI	0x6 (6)																									
VSL/VCL	0x7 (7)																									
0x05	0x06	Degas active: Indicates the status of DeGas.																								
<table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSR/VCR VSP/VCP VSL/VCL VSM/VSI</td> <td>0x0 (0)</td> <td>Fixed</td> </tr> <tr> <td rowspan="2">VSH</td> <td>0x0 (0)</td> <td>Degas is inactive (default)</td> </tr> <tr> <td>0x1 (1)</td> <td>Degas is active</td> </tr> </tbody> </table>			Type	Data	Description	VSR/VCR VSP/VCP VSL/VCL VSM/VSI	0x0 (0)	Fixed	VSH	0x0 (0)	Degas is inactive (default)	0x1 (1)	Degas is active													
Type	Data	Description																								
VSR/VCR VSP/VCP VSL/VCL VSM/VSI	0x0 (0)	Fixed																								
VSH	0x0 (0)	Degas is inactive (default)																								
	0x1 (1)	Degas is active																								
0x06	0x07	High vacuum cathode inactive: For certain vacuum processes it may be favored to suppress the start of the hot cathode (VSH) or cold cathode (VSM/VSI) sensor, which is automatically controlled by the transducer electronics.																								
<table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSR/VCR VSP/VCP VSL/VCL</td> <td>0x0 (0)</td> <td>Fixed</td> </tr> <tr> <td rowspan="2">VSM/VSI</td> <td>0x0 (0)</td> <td>Cold cathode is active (default)</td> </tr> <tr> <td>0x1 (1)</td> <td>Cold cathode is inactive</td> </tr> <tr> <td rowspan="2">VSH</td> <td>0x0 (0)</td> <td>Hot cathode is active (default)</td> </tr> <tr> <td>0x1 (1)</td> <td>Hot cathode is inactive</td> </tr> </tbody> </table>			Type	Data	Description	VSR/VCR VSP/VCP VSL/VCL	0x0 (0)	Fixed	VSM/VSI	0x0 (0)	Cold cathode is active (default)	0x1 (1)	Cold cathode is inactive	VSH	0x0 (0)	Hot cathode is active (default)	0x1 (1)	Hot cathode is inactive								
Type	Data	Description																								
VSR/VCR VSP/VCP VSL/VCL	0x0 (0)	Fixed																								
VSM/VSI	0x0 (0)	Cold cathode is active (default)																								
	0x1 (1)	Cold cathode is inactive																								
VSH	0x0 (0)	Hot cathode is active (default)																								
	0x1 (1)	Hot cathode is inactive																								
0x07	0x08	Spare Filament: VSH transmitters have two filaments. This bit indicates that the VSH transmitter has switched to the spare filament, so filament 1 is depleted.																								
<table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSR/VCR VSP/VCP VSL/VCL VSM/VSI</td> <td>0x0 (0)</td> <td>Fixed</td> </tr> </tbody> </table>			Type	Data	Description	VSR/VCR VSP/VCP VSL/VCL VSM/VSI	0x0 (0)	Fixed																		
Type	Data	Description																								
VSR/VCR VSP/VCP VSL/VCL VSM/VSI	0x0 (0)	Fixed																								

VSH	0x0 (0)	Filament 1 is active, CoE object is FALSE
	0x1 (1)	Filament 2 (spare filament) is active, CoE object is TRUE

0x08

0x09

Sensor Switch Mode: By default a combi transmitter (VSR/VCR/VSL/VCL, VSM, VSH) performs a continuous transition between its sensor principles over a pressure range, whereupon an assimilation of the sensor signals is carried out. The Sensor Switch Mode contains the actual mode.

Type	Data	Description
VSR/VCR VSL/VCL	0x0 (0)	No transition, direct switch at 1 mbar
	0x1 (1)	Continuous transition between 5 and 15 mbar (default)
	0x3 (3)	Custom transition (if set via serial interface or acyclic data)
VSP/VCP VSI	0x0 (0)	Fixed
VSM	0x0 (0)	No transition, direct switch at 1E-3 mbar
	0x1 (1)	Continuous transition between 1E-3 and 2E-3 mbar (default)
	0x3 (3)	Custom transition (if set via serial interface or acyclic data)
VSH	0x0 (0)	No transition, direct switch at 4E-4 mbar
	0x1 (1)	Continuous transition between 1E-3 and 2E-3 mbar (default)
	0x2 (2)	Continuous transition between 2E-3 and 5E-3 mbar
	0x3 (3)	Custom transition (if set via serial interface or acyclic data)

2.4 TxPDO Content (0x1A02) – Transmitter Status

Index	Index VSL/VCL	Bitsize	Name	Type
0x200F:09	0x200F:0A	1	Warning – Overrange	BIT
0x200F:0A	0x200F:0B	1	Warning – Underrange	BIT
-	-	1	-	Padding Bit
0x200F:0C	0x200F:0D	1	Error – Filament 1 defect	BIT
0x200F:0D	0x200F:0E	1	Error – Filament 2 defect	BIT
0x200F:0E	0x200F:0F	1	Error – Internal Communication	BIT
0x200F:0F	0x200F:10	1	Error – EEPROM failure	BIT
0x200F:10	0x200F:11	1	Error – Sensor defect/stacked out	BIT

Subindex	Subindex VSL/VCL	Description											
0x09	0x0A	Warning – Overrange <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td rowspan="2">all</td> <td>0x0 (0)</td> <td>No error</td> </tr> <tr> <td>0x1 (1)</td> <td>Overrange detected, pressure level exceeds the measurement range. The Actual Pressure (0x200F:01) will be set to 2E+38.</td> </tr> </tbody> </table>	Type	Data	Description	all	0x0 (0)	No error	0x1 (1)	Overrange detected, pressure level exceeds the measurement range. The Actual Pressure (0x200F:01) will be set to 2E+38.			
Type	Data	Description											
all	0x0 (0)	No error											
	0x1 (1)	Overrange detected, pressure level exceeds the measurement range. The Actual Pressure (0x200F:01) will be set to 2E+38.											
0x0A	0x0B	Warning – Underrange <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td rowspan="2">all</td> <td>0x0 (0)</td> <td>No error</td> </tr> <tr> <td>0x1 (1)</td> <td>Underrange detected, pressure level is lower than the measurement range. The Actual Pressure (0x200F:01) will be set to 2E-38.</td> </tr> </tbody> </table>	Type	Data	Description	all	0x0 (0)	No error	0x1 (1)	Underrange detected, pressure level is lower than the measurement range. The Actual Pressure (0x200F:01) will be set to 2E-38.			
Type	Data	Description											
all	0x0 (0)	No error											
	0x1 (1)	Underrange detected, pressure level is lower than the measurement range. The Actual Pressure (0x200F:01) will be set to 2E-38.											
0x0C	0x0D	Error – Filament 1 defect <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSR/VCR VSP/VCP VSL/VCL VSM/VSJ</td> <td>0x0 (0)</td> <td>Fixed</td> </tr> <tr> <td rowspan="2">VSH</td> <td>0x0 (0)</td> <td>No error</td> </tr> <tr> <td>0x1 (1)</td> <td>Filament 1 is defect</td> </tr> </tbody> </table>	Type	Data	Description	VSR/VCR VSP/VCP VSL/VCL VSM/VSJ	0x0 (0)	Fixed	VSH	0x0 (0)	No error	0x1 (1)	Filament 1 is defect
Type	Data	Description											
VSR/VCR VSP/VCP VSL/VCL VSM/VSJ	0x0 (0)	Fixed											
VSH	0x0 (0)	No error											
	0x1 (1)	Filament 1 is defect											
0x0D	0x0E	Error – Filament 2 defect <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSR/VCR VSP/VCP VSM/VSJ VSL/VCL</td> <td>0x0 (0)</td> <td>Fixed</td> </tr> <tr> <td rowspan="2">VSH</td> <td>0x0 (0)</td> <td>No error</td> </tr> <tr> <td>0x1 (1)</td> <td>Filament 2 (spare filament) is defect</td> </tr> </tbody> </table>	Type	Data	Description	VSR/VCR VSP/VCP VSM/VSJ VSL/VCL	0x0 (0)	Fixed	VSH	0x0 (0)	No error	0x1 (1)	Filament 2 (spare filament) is defect
Type	Data	Description											
VSR/VCR VSP/VCP VSM/VSJ VSL/VCL	0x0 (0)	Fixed											
VSH	0x0 (0)	No error											
	0x1 (1)	Filament 2 (spare filament) is defect											
0x0E	0x0F	Error – Internal Communication <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td rowspan="2">all</td> <td>0x0 (0)</td> <td>No error</td> </tr> <tr> <td>0x1 (1)</td> <td>Internal communication error of the transmitter electronics</td> </tr> </tbody> </table>	Type	Data	Description	all	0x0 (0)	No error	0x1 (1)	Internal communication error of the transmitter electronics			
Type	Data	Description											
all	0x0 (0)	No error											
	0x1 (1)	Internal communication error of the transmitter electronics											

0x0F 0x10

Error – EEPROM failure

Type	Data	Description
all	0x0 (0)	No error
	0x1 (1)	Failure on EEPROM

0x10

0x11

Error – Sensor defect/stacked out

Type	Data	Description
all	0x0 (0)	No error
	0x1 (1)	Sensor head is stacked out or defect

2.5 TxPDO Content (0x1A03) – Syntax

Index	Index VSL/VCL	Bitsize	Name	Type
-	-	2	-	Padding Bits
0x200F:13	0x200F:14	1	Sensor Switch Mode, Value mismatch	BIT
0x200F:14	0x200F:15	1	GCF 1, Value mismatch	BIT
0x200F:15	0x200F:16	1	GCF 2, Value mismatch	BIT
0x200F:16	0x200F:17	1	Pressure Adjust, Value mismatch	BIT
0x200F:17	0x200F:18	1	Command supported	BIT
0x200F:18	0x200F:19	1	Command invalid	BIT
0x200F:19	0x200F:1A	8	Command executed	BYTE

Subindex	Subindex VSL/VCL	Description												
0x13	0x14	Sensor Switch Mode, Value mismatch <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSP/VCP VSI</td> <td>0x0 (0)</td> <td>Fixed</td> </tr> <tr> <td>VSR/VCR VSL/VCL</td> <td>0x0 (0)</td> <td>No error</td> </tr> <tr> <td>VSM VSH</td> <td>0x1 (1)</td> <td>The value in Data Sensor Switch Mode (0x300F:05) is wrong or out of range</td> </tr> </tbody> </table>	Type	Data	Description	VSP/VCP VSI	0x0 (0)	Fixed	VSR/VCR VSL/VCL	0x0 (0)	No error	VSM VSH	0x1 (1)	The value in Data Sensor Switch Mode (0x300F:05) is wrong or out of range
Type	Data	Description												
VSP/VCP VSI	0x0 (0)	Fixed												
VSR/VCR VSL/VCL	0x0 (0)	No error												
VSM VSH	0x1 (1)	The value in Data Sensor Switch Mode (0x300F:05) is wrong or out of range												
0x14	0x15	GCF 1, Value mismatch <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSI</td> <td>0x0 (0)</td> <td>Fixed</td> </tr> <tr> <td>VSR/VCR</td> <td>0x0 (0)</td> <td>No error</td> </tr> <tr> <td>VSP/VCP VSL/VCL VSM VSH</td> <td>0x1 (1)</td> <td>The value in Data GCF 1 (0x300F:02) is wrong or out of range</td> </tr> </tbody> </table>	Type	Data	Description	VSI	0x0 (0)	Fixed	VSR/VCR	0x0 (0)	No error	VSP/VCP VSL/VCL VSM VSH	0x1 (1)	The value in Data GCF 1 (0x300F:02) is wrong or out of range
Type	Data	Description												
VSI	0x0 (0)	Fixed												
VSR/VCR	0x0 (0)	No error												
VSP/VCP VSL/VCL VSM VSH	0x1 (1)	The value in Data GCF 1 (0x300F:02) is wrong or out of range												
0x15	0x16	GCF 2, Value mismatch <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSR/VCR VSP/VCP VSL/VCL</td> <td>0x0 (0)</td> <td>Fixed</td> </tr> <tr> <td>VSM/VSI VSH</td> <td>0x0 (0)</td> <td>No error</td> </tr> <tr> <td></td> <td>0x1 (1)</td> <td>The value in Data GCF 2 (0x300F:03) is wrong or out of range</td> </tr> </tbody> </table>	Type	Data	Description	VSR/VCR VSP/VCP VSL/VCL	0x0 (0)	Fixed	VSM/VSI VSH	0x0 (0)	No error		0x1 (1)	The value in Data GCF 2 (0x300F:03) is wrong or out of range
Type	Data	Description												
VSR/VCR VSP/VCP VSL/VCL	0x0 (0)	Fixed												
VSM/VSI VSH	0x0 (0)	No error												
	0x1 (1)	The value in Data GCF 2 (0x300F:03) is wrong or out of range												
0x16	0x17	Pressure Adjust, Value mismatch <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td rowspan="2">all</td> <td>0x0 (0)</td> <td>No error</td> </tr> <tr> <td>0x1 (1)</td> <td>The value in Data Pressure (0x300F:01) is wrong or out of range</td> </tr> </tbody> </table>	Type	Data	Description	all	0x0 (0)	No error	0x1 (1)	The value in Data Pressure (0x300F:01) is wrong or out of range				
Type	Data	Description												
all	0x0 (0)	No error												
	0x1 (1)	The value in Data Pressure (0x300F:01) is wrong or out of range												
0x17	0x18	Command Supported <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td rowspan="2">all</td> <td>0x0 (0)</td> <td>Command not supported</td> </tr> <tr> <td>0x1 (1)</td> <td>No error</td> </tr> </tbody> </table>	Type	Data	Description	all	0x0 (0)	Command not supported	0x1 (1)	No error				
Type	Data	Description												
all	0x0 (0)	Command not supported												
	0x1 (1)	No error												

0x18 0x19

Command invalid

Type	Data	Description
all	0x0 (0)	No error
	0x1 (1)	Command is invalid and cannot be executed

0x19 0x1A

Command executed

Type	Data	Description
all		Contains the value of the last executed command that was written in Command (0x300F:04)

2.6 RxPDO Content (0x1600) – Outputs

Index	Bitsize	Name	Type
0x300F:01	32	Data Pressure	REAL
0x300F:02	16	Data GCF 1	UINT
0x300F:03	16	Data GCF 2	UINT
0x300F:04	8	Command	BYTE
0x300F:05	8	Data Sensor Switch Mode	BYTE

Subindex	Description																																								
0x01	Data Pressure <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>all</td> <td>Var.</td> <td>Contains a pressure value as 32bit Real</td> </tr> </tbody> </table>	Type	Data	Description	all	Var.	Contains a pressure value as 32bit Real																																		
Type	Data	Description																																							
all	Var.	Contains a pressure value as 32bit Real																																							
0x02	Data GCF 1 <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSI</td> <td></td> <td>Value will be ignored</td> </tr> <tr> <td>VSR/VCR VSP/VCP VSL/VCL VSM VSH</td> <td>0x0014 – 0x0320 (20 – 800)</td> <td>New value for the GCF 1, used for Pirani sensor (default: 100)</td> </tr> </tbody> </table>	Type	Data	Description	VSI		Value will be ignored	VSR/VCR VSP/VCP VSL/VCL VSM VSH	0x0014 – 0x0320 (20 – 800)	New value for the GCF 1, used for Pirani sensor (default: 100)																															
Type	Data	Description																																							
VSI		Value will be ignored																																							
VSR/VCR VSP/VCP VSL/VCL VSM VSH	0x0014 – 0x0320 (20 – 800)	New value for the GCF 1, used for Pirani sensor (default: 100)																																							
0x03	Data GCF 2 <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>VSR/VCR VSP/VCP VSL/VCL</td> <td></td> <td>Value will be ignored</td> </tr> <tr> <td>VSM/VSI VSH</td> <td>0x0014 – 0x0320 (20 – 800)</td> <td>New value for the GCF 2, used for cold cathode and hot cathode (default: 100)</td> </tr> </tbody> </table>	Type	Data	Description	VSR/VCR VSP/VCP VSL/VCL		Value will be ignored	VSM/VSI VSH	0x0014 – 0x0320 (20 – 800)	New value for the GCF 2, used for cold cathode and hot cathode (default: 100)																															
Type	Data	Description																																							
VSR/VCR VSP/VCP VSL/VCL		Value will be ignored																																							
VSM/VSI VSH	0x0014 – 0x0320 (20 – 800)	New value for the GCF 2, used for cold cathode and hot cathode (default: 100)																																							
0x04	Command <table border="1"> <thead> <tr> <th>Type</th> <th>Data</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td rowspan="4">all</td> <td>0x00 (0)</td> <td>Zero Command</td> </tr> <tr> <td>0x01 (1)</td> <td>Adjust High Vacuum</td> </tr> <tr> <td>0x02 (2)</td> <td>Adjust Atmospheric Pressure</td> </tr> <tr> <td>0x03 (3)</td> <td>Set Gas Correction Factors (GCF)</td> </tr> <tr> <td>VSR/VCR</td> <td>0x39 (57)</td> <td>Set Sensor Switch Mode</td> </tr> <tr> <td>VSP/VCP</td> <td>-</td> <td>No special VSP/VCP commands</td> </tr> <tr> <td rowspan="2">VSL/VCL</td> <td>0x04 (4)</td> <td>Adjust Relative Pressure</td> </tr> <tr> <td>0x39 (57)</td> <td>Set Sensor Switch Mode</td> </tr> <tr> <td rowspan="2">VSM/VSI</td> <td>0x46 (70)</td> <td>Activate Cold Cathode</td> </tr> <tr> <td>0x47 (71)</td> <td>Deactivate Cold Cathode</td> </tr> <tr> <td>VSM</td> <td>0x4D (77)</td> <td>Set Sensor Switch Mode</td> </tr> <tr> <td rowspan="4">VSH</td> <td>0x50 (80)</td> <td>Active Hot Cathode</td> </tr> <tr> <td>0x51 (81)</td> <td>Deactivate Hot Cathode</td> </tr> <tr> <td>0x55 (85)</td> <td>Activate DeGas</td> </tr> <tr> <td>0x56 (86)</td> <td>Deactivate DeGas</td> </tr> </tbody> </table>	Type	Data	Description	all	0x00 (0)	Zero Command	0x01 (1)	Adjust High Vacuum	0x02 (2)	Adjust Atmospheric Pressure	0x03 (3)	Set Gas Correction Factors (GCF)	VSR/VCR	0x39 (57)	Set Sensor Switch Mode	VSP/VCP	-	No special VSP/VCP commands	VSL/VCL	0x04 (4)	Adjust Relative Pressure	0x39 (57)	Set Sensor Switch Mode	VSM/VSI	0x46 (70)	Activate Cold Cathode	0x47 (71)	Deactivate Cold Cathode	VSM	0x4D (77)	Set Sensor Switch Mode	VSH	0x50 (80)	Active Hot Cathode	0x51 (81)	Deactivate Hot Cathode	0x55 (85)	Activate DeGas	0x56 (86)	Deactivate DeGas
Type	Data	Description																																							
all	0x00 (0)	Zero Command																																							
	0x01 (1)	Adjust High Vacuum																																							
	0x02 (2)	Adjust Atmospheric Pressure																																							
	0x03 (3)	Set Gas Correction Factors (GCF)																																							
VSR/VCR	0x39 (57)	Set Sensor Switch Mode																																							
VSP/VCP	-	No special VSP/VCP commands																																							
VSL/VCL	0x04 (4)	Adjust Relative Pressure																																							
	0x39 (57)	Set Sensor Switch Mode																																							
VSM/VSI	0x46 (70)	Activate Cold Cathode																																							
	0x47 (71)	Deactivate Cold Cathode																																							
VSM	0x4D (77)	Set Sensor Switch Mode																																							
VSH	0x50 (80)	Active Hot Cathode																																							
	0x51 (81)	Deactivate Hot Cathode																																							
	0x55 (85)	Activate DeGas																																							
	0x56 (86)	Deactivate DeGas																																							

	0x57 (87)	Set Sensor Switch Mode
--	-----------	------------------------

0x05

Data Sensor Switch Mode

Type	Data	Description
VSR/VCR	0x0 (0)	No transition, direct switch at 1 mbar
VSL/VCL	0x1 (1)	Continuous transition between 5 and 15 mbar (default)
VSP/VCP VSI	-	VSP/VCP, VSI has no transition
VSM	0x0 (0)	No transition, direct switch at 1E-3 mbar
	0x1 (1)	Continuous transition between 1E-3 and 2E-3 mbar (default)
VSH	0x0 (0)	No transition, direct switch at 4E-4 mbar
	0x1 (1)	Continuous transition between 1E-3 and 2E-3 mbar (default)
	0x2 (2)	Continuous transition between 2E-3 and 5E-3 mbar

Note: A custom transition (0x3) can be set via communication protocol V2 (see section [4.1.2](#)).

3 Commands (0x300F:04)

3.1 Command List

All commands are separated into two groups:

- General Commands, that are valid for all Smartline transmitter
- Commands, that are valid only for a specific transmitter

Rules for commands:

- Each command will be executed only once.
- Always the last executed command will be written into Command executed (0x200F:19 / 0x200F:1A)

Type	Data	Name
all	0x00 (0)	Zero Command
	0x01 (1)	Adjust High Vacuum
	0x02 (2)	Adjust Atmospheric Pressure
	0x03 (3)	Set Gas Correction Factors (GCF)
VSR/VCR	0x39 (57)	Set Sensor Switch Mode
VSP/VCP	-	No special VSP/VCP commands
VSL/VCL	0x04 (4)	Adjust Relative Pressure
	0x39 (57)	Set Sensor Switch Mode
VSM/VS	0x46 (70)	Activate Cold Cathode
	0x47 (71)	Deactivate Cold Cathode
VSM	0x4D (77)	Set Sensor Switch Mode
VSH	0x50 (80)	Active Hot Cathode
	0x51 (81)	Deactivate Hot Cathode
	0x55 (85)	Activate DeGas
	0x56 (86)	Deactivate DeGas
	0x57 (87)	Set Sensor Switch Mode

3.2 General Commands for all Smartline Transmitter

3.2.1 0x00 (0) – Zero Command

Type	Chain	PDO	Name	Data	Description
all	1.	0x300F:04	Zero Command	0x00 (0)	Clear 0x200F:19 / 0x200F:1A, allow new command

3.2.2 0x01 (1) – Adjust High Vacuum

Type	Chain	PDO	Name	Data	Description
all	1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
	2.	0x300F:01	Data Pressure	0x00 (0) *	Mandatory
	3.	0x300F:04	Command	0x01 (1)	Adjust high vacuum

* Adjustments at a certain reference pressure p (only on VSR/VCR/VSP/VCP/VSL/VCL) can be executed via communication protocol V2 (see section [4.1.2](#)).

3.2.3 0x02 (2) – Adjust Atmospheric Pressure

Type	Chain	PDO	Name	Data	Description
VSR/VCR VSL/VCL	1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
	2.	0x300F:02	Data Pressure	variable	Actual atmospheric pressure
	3.	0x300F:04	Command	0x02 (2)	Adjust atmospheric pressure
VSP/VCP VSM VSH	1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
	2.	0x300F:02	Data Pressure	0x03E8 (1000)	1000 mbar
	3.	0x300F:04	Command	0x02 (2)	Adjust atmospheric pressure

3.2.4 0x03 (3) – Set Gas Correction Factors

Type	Chain	PDO	Name	Data	Description
VSR/VCR VSP/VCP VSL/VCL	1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
	2.	0x300F:02	Data GCF 1 Pirani	0x0014 (20) – 0x0320 (800)	Gas Correction Factor for Pirani
	3.	0x300F:03	Data GCF 2 CC / BA	d.c.	Value will be ignored
	4.	0x300F:04	Command	0x03 (3)	Set GCF factors
VSM VSH	1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
	2.	0x300F:02	Data GCF 1 Pirani	0x0014 (20) – 0x0320 (800)	Gas Correction Factor for Pirani
	3.	0x300F:03	Data GCF 2 CC / BA	0x0014 (20) – 0x0320 (800)	Gas Correction Factor for Cold Cathode (CC) or Hot Cathode (BA)
	4.	0x300F:04	Command	0x03 (3)	Set GCF factors
VSI	1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
	2.	0x300F:02	Data GCF 1 Pirani	d.c.	Value will be ignored
	3.	0x300F:03	Data GCF 2 CC / BA	0x0014 (20) – 0x0320 (800)	Gas Correction Factor for Cold Cathode (CC)
	4.	0x300F:04	Command	0x03 (3)	Set GCF factors

3.3 VSR/VCR Commands

3.3.1 0x39 (57) – Set Sensor Switch Mode

Chain	PDO	Name	Data	Description
1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
2.	0x300F:05	Data Sensor Switch Mode	0x0 (0) or 0x1 (1) *	
3.	0x300F:04	Command	0x39 (57)	Set sensor switch mode

3.4 VSL/VCL Commands

3.4.1 0x04 (4) – Adjust Relative Pressure

Chain	PDO	Name	Data	Description
1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
2.	0x300F:01	Data Pressure	d.c.	Value will be ignored
3.	0x300F:04	Command	0x04 (4)	Adjust relative pressure to zero

3.4.2 0x39 (57) – Set Sensor Switch Mode

Chain	PDO	Name	Data	Description
1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
2.	0x300F:05	Data Sensor Switch Mode	0x0 (0) or 0x1 (1) *	
3.	0x300F:04	Command	0x39 (57)	Set sensor switch mode

3.5 VSM/VSJ Commands

3.5.1 0x46 (70) – Activate Cold Cathode

Chain	PDO	Name	Data	Description
1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
2.	0x300F:04	Command	0x46 (70)	Activate cold cathode

3.5.2 0x47 (71) – Deactivate Cold Cathode

Chain	PDO	Name	Data	Description
1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
2.	0x300F:04	Command	0x47 (71)	Deactivate cold cathode

3.6 VSM Commands

3.6.1 0x4D (77) – Set Sensor Switch Mode

Chain	PDO	Name	Data	Description
1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
2.	0x300F:05	Data Sensor Switch Mode	0x0 (0) or 0x1 (1) *	
3.	0x300F:04	Command	0x4D (77)	Set sensor switch mode

3.7 VSH Commands

3.7.1 0x50 (80) – Activate Hot Cathode

Chain	PDO	Name	Data	Description
1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
2.	0x300F:04	Command	0x50 (80)	Activate hot cathode

3.7.2 0x51 (81) – Deactivate Hot Cathode

Chain	PDO	Name	Data	Description
1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
2.	0x300F:04	Command	0x51 (81)	Deactivate hot cathode

3.7.3 0x55 (85) – Activate DeGas

Chain	PDO	Name	Data	Description
1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
2.	0x300F:04	Command	0x55 (85)	Activate DeGas

3.7.4 0x56 (86) – Deactivate DeGas

Chain	PDO	Name	Data	Description
1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
2.	0x300F:04	Command	0x56 (86)	Deactivate DeGas

3.7.5 0x57 (87) – Set Sensor Switch Mode

Chain	PDO	Name	Data	Description
1.	0x300F:04	Zero Command	0x00 (0)	Mandatory if not 0x00
2.	0x300F:05	Data Sensor Switch Mode	0x0 (0), 0x1 (1) or 0x2 (2) *	
3.	0x300F:04	Command	0x57 (87)	Set sensor switch mode

* A custom transition (0x3) can be set via communication protocol V2 (see section [4.1.2](#)).

4 Acyclic Data Exchange

4.1.1 Firmware Update (0x4000)

Chain	Index	Name	Data	Description
1.	0x4000:01	Firmware Update	0x01 (1)	Start Firmware Update

Note: The update can only be executed in “Pre-Op” state. Otherwise, an EtherCAT specific error is generated.

Note: Before executing the update, the corresponding firmware file “FWUPDATE.ZIP” has to be downloaded to the transmitter via FoE (File Access over EtherCAT).

4.1.2 Communication Protocol V2 (0x400F)

Using acyclic data exchange, the limited range of commands in cyclic data communication to configure a gauge is now extended to all commands available (see the corresponding transmitter manual). For sending and receiving acyclic data records a simplified version of the Thyracont communication protocol V2 needs to be applied. The protocol documentation with more information regarding the commands can be found on our homepage (see also chapter 5). The following table shows the parameters to apply in your tool for using the acyclic data exchange:

Chain	Index	Name	Data
1.	0x400F:02	Write data	See Thyracont communication protocol V2 (max. 104 bytes allowed to be transmitted)
2.	0x400F:01	Read response	See Thyracont communication protocol V2 (max. 110 bytes to be received)

In general, each command (independent of writing data to, or reading data from the gauge) needs to be sent via "Write data". The response of the device can then be read out via "Read response" within **6 seconds**. After this time, the response will be an EtherCAT general error.

In case of configuration commands, it is recommended to evaluate the device response for success or error.

5 Additional Files (ESI, Documentation)

You can download the ESI files and related documents (transmitter, communication protocol) from the Thyracont webpage:

1. Open Thyracont webpage <https://thyracont-vacuum.com/>
2. Browse to Support → [Download Center](#)
3. Section “Smartline - Intelligent Vacuum Measurement”
 - a. Transmitter manuals (PDF)
 - b. ESI files (ZIP)
4. Section “Software and Apps, protocols, drivers and other”
 - a. Communication manuals (PDF)

6 Document History

Date	Version	Comment	Revision Number (0x1018:13)	Software Version (0x100A)
2014-01-14	1.0	Initial Release v1.0	0x2774 (10100)	-
2014-03-17	1.1	Editorial changes	0x2774 (10100)	-
2014-05-30	1.2	Description of CoE Objects (first public release)	0x2774 (10100)	3.0e
2014-07-09	1.3	1.) Several names of parameters changed and editorial changes of their description 6000:01 → “Actual GCF 1” 6000:02 → “Actual GCF 2” 6000:07 → “Spare Filament” 6000:14 → “Error – GCF 1, value mismatch” 6000:15 → “Error – GCF 2, value mismatch” 7000:01 → “Data GCF 2” 7000:03 → “Data GCF 1” 2.) Notes on Display Bug of TwinCAT added for Sensor Type (0x6000:04) and Sensor Switch Mode (0x6000:08)	0x27D8 (10200)	3.0g
2016-02-03	1.3	Typing errors in RxPDO Content (0x1A01)		
2017-11-06	1.3	Some corrections		
2018-11-16	1.4	Some corrections		
2021-06-25	1.5	Added VSI/VCP/VCR		
2022-03-01	1.7	New ESI New object index: 200F instead of 6000 300F instead of 7000	0x03040101	3.4.2
2025-05-26	2.0	New EtherCAT module → New ESI → New objects: 0x4000, 0x400F Integrated VSL/VCL, some corrections	0x03040200	1.0.0.1 (5.4.0.14)

7 License

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