INSTALLATION MANUAL SUPPLEMENT FOR VALVES WITH IO-LINK

Series D1FP/D3FP, D1FE/D3FE, D30FP, D*1FP, D*1FE, TDP/TEP, TPQ, TFP

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1. Introduction

1.1 Validity of the documentation

The documentation applies to direct-operated and pilot-operated proportional valves of the series:

- D1FP / D3FP
- D1FE / D3FE
- D30FP
- D*1FP
- D*1FE
- TDP / TEP
- TPQ
- TFP

⚠ This documentation is intended for plant fitters, operators, service technicians, plant supervisors, machine, and plant manufacturers.

Information about vendor data	
Vendor ID	271
Vendor Name	Parker Hannifin
Vendor Text	www.parker.com
Vendor-URL	http://www.parker.com

1.2 Overview device ID

Device ID	Device	Design
917765	DFplus direct operated standard - IO Link Class A	50
918280	DFplus pilot operated - IO Link Class A	50
917764	DFplus direct operated - IO Link Class B	50
918280	DFplus pilot operated - IO Link Class B	50
918280	TFP - IO Link Class A	20
918280	TDP / TEP - IO-Link Class A	70
918280	TPQ - IO-Link Class A	70
918280	DFplus D direct operated - IO-Link Class A	50
918280	DFplus D direct operated - IO-Link Class B	50

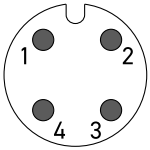
2. Technical data

Physical		
Input	[V]	24 pulse modulated
Baudrate	[kbit/s]	230.4; COM3
Interface		Class A; Class B
Netzwerk Topology		Point to point
Cable Length, max.	[m]	20
Cabel Type		Class A - 4 wires, unshielded Class B - 5 wires, unshielded
Process data and communication		
Minimal cycle time	[ms]	2.2
Process data input	[Byte]	8
Process data output	[Byte]	4 Byte
Number input data		2 words
Number output data		4 words
Device type		Device – supported feature 1. Cyclic transmission of process data 2. Acyclic transmission of parameters 3. Acyclic transmission of identification data 4. Acyclic transmission of diagnostic data
Configuration and Transfer		
		1. Communication and parameterization via Parker USB IO-Link Master and ProPXD software 2. Communication and parameterization via IO-Link Master 3. Kommunikation und Parametrierung via PLC
Diagnostic Events		
Update time	[ms]	1
Event category type		Error; Warning; Information
Status code		Type 2 with details
Number of the last occurring errors		10 max.

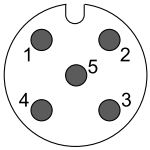
3. Wiring

PIN assignment IO-Link parameterization and communication interface.
PIN assignment according to IEC 60974-5-2.

3.1 IO-Link A Class

	Pin	Signal	Pin Assignment - A Class
	1	L+	Power supply IO-Link
	3	L-	Reference Potential to Pin 1
	4	C/Q	IO-Link data line (SDCI)

3.2 IO Link B Class

	Pin	Signal	Pin Assignment - B Class
	1	L+	Power supply IO-Link
	2	P24	Power supply valve electronic and amplifier - Power Requirement min. 2A
	3	L-	Reference Potential to Pin 1
	4	C/Q	IO-Link data line (SDCI)
	5	N24	Reference Potential to Pin 2

4 Reaction to IO Link communication errors

4.1 Interruption of power supply

4.1.1 Valve with IO-Link Class A

Supply Voltage Off	Reaction of Device
Power supply of the valve (6+PE / 11+PE)	Electronic and amplifier shut off. · Valve will go in power down, valve spool in defined power down position. · IO-Link-Communication is active via the IO Link power supply Pin 1
Power supply of IO-Link (24 VDC M12 Anschluss PIN 1)	Switching off the power supply of the IO-Link – pin 1 has following effects on function of the valve. · SET POINT and CONTROL WORD Local The valve remains in operation, communication with the valve via IO-Link is not possible. · SET POINT and CONTROL WORD via IO-Link Bus The valve goes into the disabled state, communication with the valve via IO-Link is not possible.

4.1.2 Valve with IO-Link Class B

Supply Voltage Off	Reaktion des Ventils
Power supply valve electronic and amplifier (24 VDC M12 connector PIN 2)	Electronic and amplifier shut off. · Valve will go in power down, valve spool in defined power down position. · IO-Link-Communication is active via the IO Link power supply Pin 1
Power supply of IO-Link (24 VDC M12 connector PIN 1)	An interruption of the power supply will lead to an interruption of communication via IO-Link. The valve goes into the disabled state.

4.2 Interruption of IO-Link communication

Device	CONTROL WORD and SET POINT	Reaction of Device
IO-Link Class A	Local	Valve remains in operation
	BUS	Valve goes into the Disable state. The device signals this by means of a red glowing status LED. The error must be eliminated and then acknowledged via a Disable/Enable or Power Off/On.
IO-Link Class B	BUS	Valve goes into the Disable state. The device signals this by means of a red glowing status LED. The error must be eliminated and then acknowledged via a Disable/Enable or Power Off/On.

4.3 Receiving of incorrect process data

Process data	Reaction
ENABLE	Device will stay in DISABLE
SETPOINT	In the case of setpoint signal over 100% the setpoint signal will be limited on 100%

4.4 Device behavior in case of invalid IO-Link data from the master

If the data sent by the master is labelled as "invalid", the process data is reset.

Due to the zeroed process data, the valve switches to the "Init" operating state and receives a

setpoint value of 0%.

The valve can then be put back into normal operation by setting a new "Control Word".

4.5 Device behavior in case of invalid data from the valve

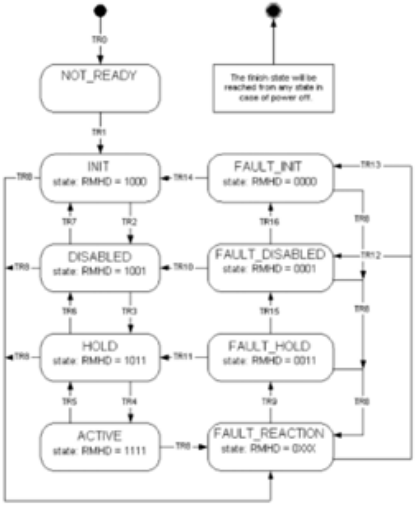
If the output process data is marked as "invalid" by the valve, the valve continues to operate

normally because it does not affect the valve function.

Internal errors are handled via error handling. abgehandelt.

5 Communication

5.1 Device states



State	Actions
NOT READY	• The electronic circuit has power. • Self-test running • Parameter are copied to RAM to be able to configure hardware functions. • Device init running (e. g. communication interface, hardware, software) • Device function disabled, spool position not valid. • Status Word is not valid and not needed here as communication is not enabled yet
INIT	• Communication enabled • All Device Parameter can be set. • Device function disabled (Current and position control disabled)
DISABLED	• Device parameters can be set. • Device function disabled. • Actual values are available
HOLD	• Hold setpoint is active. • Current and position control active • The setpoint generated in the state Device Mode ACTIVE is not effective
ACTIVE	• Device parameters can be set. • The device mode defined by the device mode parameter is active. • In this state the change of device modes is not admitted (write access to the device mode parameter will be responded negatively)
FAULT_INIT	• Device parameters can be set. • Device function disabled
FAULT_DISABLED	• Device parameters can be set. • Device function disabled. - • Actual values are available
FAULT HOLD	• Device parameters can be set. • Device function disabled. • Actual values are available. • The hold setpoint is effective. • The setpoint generated in the state Device Mode ACTIVE is not effective
FAULT REACTION	• This state is assumed when the device detects an error. • A fault dependent vendor specific action is executed. • The resulting fault state is depending on the error reaction setting of the error. • Important condition for transitions 9, 12, 13: The RMHD bits are not allowed to rise!

5.2 State Transitions

Transitions	Old State	New State	Actions
TR0	Switched off	NOT_READY	· Start up code · HW initialisation
TR1	NOT_READY	INIT	· Enable Interrupts · Enable setting of INIT only parameters
TR2	INIT	DISABLED	· Disable setting of INIT only parameters · Calculate normalisation parameter
TR3	DISABLED	HOLD	· Internal setpoint = hold setpoint · Enable current controller. · Enable pilot controller. · Enable main spool controller
TR4	HOLD	ACTIVE	· Internal setpoint = external setpoint
TR5	ACTIVE	HOLD	· Internal setpoint = hold setpoint
TR6	HOLD	DISABLED	· Disable current controller. · Disable pilot controller. · Disable main spool controller
TR7	DISABLED	INIT	· Enable setting of INIT only parameters
TR8	all but not NOT_READY	FAULT_REACTION	· Trigger specified error reaction(s)
TR9	FAULT_REACTION	FAULT_HOLD	· Error reset · Internal setpoint = hold setpoint
TR10	FAULT_DISABLED	DISABLED	· Error reset
TR11	FAULT_HOLD	HOLD	· Error reset
TR12	FAULT_REACTION	FAULT_DISABLED	· Disable current controller. · Disable pilot controller · Disable main spool controller
TR13	FAULT_REACTION	FAULT_INIT	· Disable current controller · Disable pilot controller · Disable main spool controller
TR14	FAULT_INIT	INIT	

5.3 Status word

16 Bit / Bit Nr.	Status Word Bits
0	disabled (D)
1	disabled (D)
2	hold enable (H)
3	ready (R)
4	local control
5	warning
6	Reserved
7	not used

16 Bit / Bit Nr.	Status Word Bits
8	not used
9	ramping
10	reserved
11	reserved
12	reserved
13	HW enable level
14	UB_present (Power Supply)
15	position OK

Disabled, Hold, Device Mode Active, Ready

These bits determine the device condition.

Function	Bit	Description
Local control	bit = 0	The control word transmitted via bus is effective
	bit = 1	The control word is given locally, and the control word transmitted via bus will be ignored (see local mode switch function)
Warning	bit = 0	No warnings
	bit = 1	Collective message for vendor specific warnings. The type of warning will be indicated by a vendor specific parameter.
Ramping	bit = 0	Demand value is equal to the setpoint value.
	bit = 1	The ramp function has not yet reached its limit.
HW enable level	bit = 0	LOW
	bit = 1	HIGH
U b present (Indicates whether the supply voltage of power stage is present)	bit = 0	no present
	bit = 1	present
Position OK Information if position monitoring is active.	bit = 0	Unsafe position valve spool is not in the mechanical defined power down position
	bit = 1	Safe position valve spool is in the mechanical defined power down position

Variable	Variable ID	Description	Index	Datatype	Bit	Code	R/W	Description value	Unit
Vendor Name	V_Vendor_Name	The vendor name that is assigned to a Vendor ID	16	StringT	64	UTF-8	Read	Parker Hannifin	
Vendor Text	V_Vendor_Text	additional information about the vendor	17	StringT	64	UTF-8	Read	Hydraulic Valve Systems Division Europe	
Product Name	V_Product_Name	Complete product name	18	StringT	64	UTF-8	Read		
Product ID	V_Product_ID	Vendor-specific product or type identification (e.g., item number or model number)	19	StringT	64	UTF-8	Read		
Product Text	V_Product_Text	Additional product information for the device	20	StringT	64	UTF-8	Read		
Serial Number	V_Serial_Number	Unique, vendor-specific identifier of the individual device	21	StringT	16	UTF-8	Read		
Hardware Revision	V_Hardware_Revision	Unique, vendor-specific identifier of the hardware revision of the individual device	22	StringT	64	UTF-8	Read		
Firmware Revision	V_Firmware_Revision	Unique, vendor-specific identifier of the firmware revision of the individual device.	23	StringT	64	UTF-8	Read		
Application-specific Tag	V_ApplicationSpecificTag	Possibility to mark a device with user- or application-specific information	24	StringT	32	UTF-8	Read/Write		
Function Tag	V_CP_FunctionTag	Possibility to mark a device with function-specific information.	25	StringT	32	UTF-8	Read/Write		
Location Tag	V_CP_LocationTag	Possibility to mark a device with location-specific information	26	StringT	32	UTF-8	Read/Write		
Valve Type	V_Valve_Type	Valve family (Parker ident.).If type is unknown update the firmware to the last working version.	64	UIntegerT	8	UTF-8	Read	1 = Direct CTRLD 2 = Pilot CTRLD 255 = UNKNOWN	
Production Date Code	V_Production_Date_Code	Production date code (e-board Parker ident.)	65	StringT	2	UTF-8	Read		
Manufacturer Tracking Code	V_Manufacturer_Tracking_Code	Manufacturer tracking code (e-board suplier ident.)	66	StringT	50	UTF-8	Read		
Electronic Hardware Version	V_Electronic_Hardware_Version	Electronic Hardware Version (e-board Parker ident.)	67	StringT	8	UTF-8	Read		
CRC Calculation	V_CRC_Calculation	Calculate checksums	85	UIntegerT	8		Read/Write		
Checksum Active Parameter Setting	V_Checksum_Active_Parameter_Setting	Checksum over active parameters (user changed)	86	UIntegerT	4		Read	0 .. 4294967295	
Checksum Default Parameter Setting	V_Checksum_Default_Parameter_Setting	hecksum over default parameters (manufacturing setting)	87	UIntegerT	4		Read	0 .. 4294967295	
Checksum Total Parameter Setting	V_Checksum_Total_Parameter_Setting	Checksum overall parameters (supplied setting)	88	UIntegerT	32		Read	0 .. 4294967295	
Device Local	V_Device_Local	Indicates the source of the control word acting on the device state machine,	96	UIntegerT	8		Read / Write	0 = Control word via bus; (IO-Link class B – default) 1 = Control word locally; (IO-Link class A – default)	
Device Mode	V_Device_Mode	Device mode (setpoint input)	97	UIntegerT	8		Read / Write	1 = Setpoint input via bus; (IO-Link class B – default) 2 = Setpoint input locally; (IO-Link class A – default)	
Hold Setpoint	V_Hold_Setpoint	Internal setpoint in device state HOLD	100	FloatT	32		Read / Write	-100 100	

Variable	Variable ID	Description	Index	Datatype	Bit	Code	R/W	Description value	Unit
Enable Behavior	V_Enable_Behavior	Determines enable/disable reaction of the state machine	101	UIntegerT	8		Read/Write	0 = NONE 1 = INIT 2 = DISABLE 3 = HOLD	
Demand Signal Analog Input Type	V_Demand_Signal_Analog_Input_Type	Selection of the analog demand signal type	256	UIntegerT	8		Read	0 = 0…10V 1 = ±10V 2 = 4… 12… 20mA 3 = 4… 20mA 4 = ±10mA 5 = ±20mA 6 = ±50mA	
Demand Signal Analog Factorisation	V_Demand_Signal_Analog_Factorisation	Set the demand signal to a range	257	FloatT	32		Read	-200...200	%
Demand Signal Analog Cable Break	V_Demand_Signal_Analog_Cable_Break	Analog demand signal cable break detection	258	UIntegerT			Read	False = Off true = On	
Diagnose A Output Signal Type	V_Diagnosis_A_Output_Signal_Type	Set the diagnostic output A signal type	264	UIntegerT	8		Read/Write	1 = ±10V bipolar 2 = 4…12…20mA bipolar 3 = 4…20mA unipolar	
Diagnose A Measuring Point	V_Diagnosis_A_Measuring_Point	Diagnosis A measuring point	268	UIntegerT	8		Read/Write	1 = ACTUAL POSITION DEFAULT 2 = SETPOINT INTERN 3 = SETPOINT EXTERN 4 = SETPOINT BUS 5 = DMD VALUE 6 = CMD PILOTSTAGE 7 = CMD CURRENT 8 = TESTSIGNAL 9 = ACTUAL POS PILOTSTAGE 10 = ACTUAL CURRENT 11 = ACTUAL TEMP MCU 12 = ACTUAL TEMP LVDT 13 = ACTUAL VOLTAGE SUPPLY 14 = POSCTRL PILOT OUTPUT 15 = POSCTRL PILOT ERR 16 = ACTUAL VEL PILOTSTAGE 17 = ACTUAL VEL PILOTSTAGE; FILTERED 18 = CURRENT CTRL OUTPUT 19 = CURRENT CTRL ERR 20 = PWM DUTY CYCLE 21 = ACTUAL POSITION RAW	
Offset Adjustment	V_Offset_Adjustment	Adjustment of the zero position	276	Float32T	32		Read/Write	-30 .. 30	%
MIN Overlap Comp On/Off	V_MIN_Overlap_Comp_On_Off	Activate/Deactivate MIN overlap compensation	277	BooleanT			Read/Write	False = Off true = On	
MIN A-Channel	V_MIN_A_Channel	Set the coverage compensation for valve side A	278	FloatT	32		Read/Write	0 .. 49	%
MIN B-Channel	V_MIN_B_Channel	Set the coverage compensation for valve side B	279	FloatT	32		Read/Write	0 .. 49	%
MAX A-Channel	V_MAX_A_Channel	Set the maximum stroke for valve side A	280	FloatT	32		Read/Write	51 .. 110	%
MAX B-Channel	V_MAX_B_Channel	Set the maximum stroke for valve side B	281	UIntegerT	32		Read/Write	51 .. 110	%

Variable	Variable ID	Description	Index	Datatype	Bit	Code	R/W	Description value	Unit
Ramp Type	V_Ramp_Type	Selection of the ramp type	284	UIntegerT	8		Read/Write	0 = No ramps 3 = Linear (4 values)	
Ramp Up Time Quadrant I	V_Ramp_Up_Time_Quadrant_I	Ramp increasing rate for quadrant II	285	UIntegerT	2		Read/Write	0 .. 32500	ms
Ramp Down Time Quadrant I	V_Ramp_Down_Time_Quadrant_I	Ramp decreasing rate for quadrant II	286	UIntegerT	2		Read/Write	0 .. 32500	ms
Ramp Up Time Quadrant III	V_Ramp_Up_Time_Quadrant_III	Ramp increasing rate for quadrant III	289	UIntegerT	2		Read/Write	0 .. 32500	ms
Ramp Down Time Quadrant III	V_Ramp_Down_Time_Quadrant_III	Ramp decreasing rate for quadrant III	290	UIntegerT	2		Read/Write	0 .. 32500	ms
LED Ring On Off	V_LED_Ring_On_Off	On/Off LED ring	295	BooleanT			Read/Write	False = Off true = On	
Power On Delay Time	V_Power_On_Delay_Time	Delay time after switching on the device	300	UIntegerT	2		Read/Write	0 .. 4000	
Main Stage Feedback Signal Type	V_Main Stage Feedback Signal Type	2. Control Loop - Actual Value Selection	512	uint	8		Read/Write	0: 0… 10V 1: +-10V 2: 4… 12...20mA 3: 4… 20mA	
Main Stage Feedback Signal Factorisation	V_Main Stage Feedback Signal Factorisation	2. Control Loop - Adjust the main stage feedback signal to a range	513	Float	32		Read/Write		%
Main Stage Feedback Signal Cable Break	V-Main Stage Feedback Signal Cable Break	2. Control Loop - Analog main stage feedback signal cable break detection	514	boolean			Read/Write	False = Off true = On	%
Main Stage Feedback Symmetry Offset	V-Main Stage Feedback Symmetry Offset	2. Control Loop - Symmetry adjustment to the main stage	515	float	32		Read/Write		
Main Stage Feedback Max A	V_Main Stage Feedback Max A	2. Control Loop - Max A flow adjustment to the main stage	516	float	32		Read/Write		%
Main Stage Feedback Max B	V_Main Stage Feedback Max B	2. Control Loop - Max B flow adjustment to the main stage	517	float32	32		Read/Write		%
Main Stage Sensor Power Check	V_Main Stage Sensor Power Check	2. Control Loop - Checks if the sensor power of the main stage is available	518	boolean			Read/Write	False = Off true = On	%
Main CTRL Mode	V_Main CTRL Mode	2. Control Loop - Main CTRL Mode	520	uint			Read/Write	0: Controlled 1: Closed loop controled 2 bis 7: Reserve – not activated	
Main CTRL Sampling Time	V_Main CTRL Sampling Time	2. Control Loop - Main CTRL Sampling Time	521				Read/Write		
Main CTRL Error Limit	V_Main CTRL Error Limit	2. Control Loop - Limitation of Control Error	522	float	32		Read/Write		
Main CTRL Bypass Gain	V_Main CTRL Bypass Gain	2. Control Loop – Main CTRL Bypass Gain	523	float32	32		Read/Write		%
Main CTRL Bypass Portion Limit	V_Main CTRL Bypass Portion Limit	2. Control Loop - Main CTRL Bypass Portion Limit	524	float32	32		Read/Write		
Main CTRL Proportional Gain	V_Main CTRL Proportional Gain	2. Control Loop - Main CTRL Proportional (P) Gain	525	float	32		Read/Write		%
Main CTRL Proportional Portion Limit	V_Main CTRL Proportional Portion Limit	2. Control Loop - Main CTRL Proportional (P) Portion Limit	526	float	32		Read/Write		
Main CTRL Integrator Gain	V_Main CTRL Integrator Gain	2. Control Loop - Main CTRL Integrator (I) Gain	527	float	32		Read/Write		%
Main CTRL Integrator Portion Limit	V_Main CTRL Integrator Portion Limit	2. Control Loop - Main CTRL Integrator (I) Portion Limit	528	float	32		Read/Write		0
Main CTRL Integrator Window	V_Main CTRL Integrator Window	2. Control Loop - Main CTRL Integrator (I) Window	529	float	32		Read/Write		0
Main CTRL Integrator Hold	V_Main CTRL Integrator Hold	2. Control Loop - Main CTRL Integrator Hold	530	float	32		Read/Write		

Variable	Variable ID	Description	Index	Data type	Bit	Code	R/W	Description value	Unit
Main CTRL Integrator Reset	V_Main CTRL Integrator Reset	2. Control Loop - Main CTRL Integrator Reset	531	float	32		Read/Write		
Main CTRL Integrator Step Limit	V_Main CTRL Integrator Step Limit	2. Control Loop - Main CTRL Integrator (I) Step Limit	532	float	32		Read/Write		0
Main CTRL Speed Gain	V_Main CTRL Speed Gain	2. Control Loop - Main CTRL Speed (V) Gain	533	float	32		Read/Write		0
Main CTRL Speed Portion Limit	V_Main CTRL Speed Portion Limit	2. Control Loop - Main CTRL Speed (V) Portion Limit	534	float	32		Read/Write		0
Main CTRL Output Limit	V_Main CTRL Output Limit	2. Control Loop - Main CTRL Output Limit	535	float	32		Read/Write		0
Pilot CTRL Ratio to Main-Stage Position Ctrl	V_Pilot CTRL Ratio to Main-Stage Position Ctrl	2. Control Loop - Main CTRL Ratio to Main-Stage Position Ctrl	536	float	32		Read/Write		1
Main CTRL CTRL Cut-Off Frequency Velocity	V_Main CTRL CTRL Cut-Off Frequency Velocity	2. Control Loop - Main CTRL CTRL Cut-Off Frequency Velocity	537	float	32		Read/Write		0
Main CTRL CMD Speed Gain	V_Main CTRL CMD Speed Gain	2. Control Loop - Main CTRL CMD Speed Gain	538	float	32		Read/Write		0
MAIN CTRL Cut-Off Frequency CMD Velocity	V_MAIN CTRL Cut-Off Frequency CMD Velocity	2. Control Loop - Main CTRL Cut-Off Frequency CMD Velocity	539	float	32		Read/Write		0
Main CTRL CMD Velocity Portion Limit	V_Main CTRL CMD Velocity Portion Limit	2. Control Loop - Main CTRL CMD Velocity Portion Limit	540	float	32		Read/Write		0
Main CTRL Output Inversion	V_Main CTRL Output Inversion	2. Control Loop - Main CTRL inversion of the output	541	boolean			Read/Write	False = Off true = On	
Validate Error Reaction Type	V_Validate_Error_Reaction_Type	Set reaction type of the chosen error	768	UIntegerT	8		Read/Write	0 = NONE 1 = LOGGING	
Validate Error Code	V_Validate_Error_Code	Chosen error to validate	769	UIntegerT	2		Read/Write	1 .. 127	
Validate Error Counter	V_Validate_Error_Counter	Number of occurred errors of the chosen error	770	UIntegerT	2		Read	0 .. 65535	
Validate Auto Acknowledge	V_Validate_Auto_Acknowledge	Auto acknowledge of each error	771	UIntegerT	8		Read/Write	0 = Off 1 = On	
Operating Time Days	V_Operating_Time_Days	Daily counter in which the device is in operation	800	UIntegerT	2		Read	0 .. 65535	d
Operating Time Hours	V_Operating_Time_Hours	Hour counter in which the device is in operation	801	UIntegerT	2		Read	0 .. 24	h
Operating Time Minutes	V_Operating_Time_Minutes	Minute counter in which the device is in operation	802	UIntegerT	2		Read	0 .. 60	min
Operating Time Overall Minutes	V_Operating_Time_Overall_Minutes	Total minute counter in which the device is in operation	803	UIntegerT	4		Read	0 .. 4294967295	min
On Off Cycles	V_On_Off_Cycles	Counter how often the device was switched on off	805	UIntegerT	4		Read	0 .. 4294967295	
Device Supply Voltage Actual	V_Device_Supply_Voltage_Actual	Actual applied supply voltage of the device	810	Float32T			Read	0 .. 50	V
Device Supply Voltage Max	V_Device_Supply_Voltage_Max	Maximum applied supply voltage of the device	811	Float32T			Read	0 .. 50	V
Device Supply Voltage Avg	V_Device_Supply_Voltage_Avg	DAverage supply voltage of the device	812	Float32T			Read	0 .. 50	V
Device Current Actual	V_Device_Current_Actual	Actual current consumption of the device	813	Float32T			Read	0 .. 10	A
Device Current Max	V_Device_Current_Max	Maximum current consumption that occurred on the device	814	Float32T			Read	-10 .. 10	A
Device Current Avg	V_Device_Current_Avg	Average current consumption of the device	815	Float32T			Read	-10 .. 10	A
Device Power Actual	V_Device_Power_Actual	Actual consumed power by the device	816	Float32T			Read	0 .. 500	W
Device Power Max	V_Device_Power_Max	Maximum power consumption that occurred on the device	817	Float32T			Read	0..500	W

Variable	Variable ID	Description	Index	Datatype	Bit	Code	R/W	Description value	Unit
Device Power Avg	V_Device_Power_Avg	Average power consumption of the device	818	Float32T			Read	0..500	W
Temperature In Housing Actual	V_Temperature_In_Housing_Actual	Actual temperature of the electronic	831	IntegerT	2		Read	-50..200	°C
Temperature In Housing Min	V_Temperature_In_Housing_Min	Minimum temperature that occurred of the electronic	832	IntegerT	2		Read	-50 .. 200	°C
Temperature In Housing Max	V_Temperature_In_Housing_Max	Maximum temperature that occurred of the electronic	833	IntegerT	2		Read	-50 .. 200	°C
Temperature In Housing Avg	V_Temperature_In_Housing_Avg	Average temperature that occurred of the electronic	834	IntegerT	2		Read	-50 .. 200	°C
Pilot Position Min	V_Pilot_Position_Min	Minimum pilot position that occurred	847	Float32T			Read	-200 .. 200	%
Pilot Position Max	V_Pilot_Position_Max	Maximum pilot position that occurred	848	Float32T			Read	-200 .. 200	%
Pilot Position Avg	V_Pilot_Position_Avg	Maximum pilot position that occurred	849	Float32T			Read	-200 .. 200	%
Command Min	V_Command_Min	Minimum command that occurred	853	Float32T			Read	-200 .. 200	%
Command Max	V_Command_Max	Maximum command that occurred	854	Float32T			Read	-200 .. 200	%
Command Avg	V_Command_Avg	Average command during operation	855	Float32T			Read	-200 .. 200	%
Pilot FailSafe Position	V_Pilot_FailSafe_Position	Pilot fail-safe position	857	Float32T			Read	-120 .. 120	%
Movement Pilot Mio	V_Movement_Pilot_Mio	Total movement distance of the pilot, 1=1Million 100% stroke	858	UIntegerT	4		Read	0 .. 4294967295	
Movement Pilot	V_Movement_Pilot	Total movement distance of the pilot, 1=100% stroke	860	Float32T			Read	0 .. 1E+6	
Error Word	V_Error_Word	Current pending error	1056	UIntegerT	2		Read	Error code list; chapter 8	
Error Memory 1 Error	V_Error_Memory_1_Error	Error memory 1 occurred error.	1064	UIntegerT	2		Read	Error code list; chapter 8	
Error Memory 1 Day	V_Error_Memory_1_Day	Error memory 1 day in which the error occurred	1065	UIntegerT	2		Read	0 .. 65535	d
Error Memory 1 Hour	V_Error_Memory_1_Hour	Error memory 1 hour in which the error occurred	1066	UIntegerT	2		Read	0 .. 24	h
Error Memory 1 Minute	V_Error_Memory_1_Minute	Error memory 1 minute in which the error occurred	1066	UIntegerT	2		Read	0 .. 1440	min
Error Memory 2 Error	V_Error_Memory_2_Error	Error memory 1 occurred error	1068	UIntegerT	2		Read	Error code list; chapter 8	
Error Memory 2 Day	V_Error_Memory_2_Day	Error memory 2 day in which the error occurred	1069	UIntegerT	2		Read	0 .. 65535	d
Error Memory 2 Hour	V_Error_Memory_2_Hour	Error memory 2 hour in which the error occurred.	1070	UIntegerT	2		Read	0 .. 24	h
Error Memory 2 Minute	V_Error_Memory_2_Minute	Error memory 2 minute in which the error occurred	1071	UIntegerT	2		Read	0 .. 1440	min
Error Memory 3 Error	V_Error_Memory_3_Error	Error memory 3 occurred error.	1072	UIntegerT	2		Read	Error code list; chapter 8	
Error Memory 3 Day	V_Error_Memory_3_Day	Error memory 3 day in which the error occurred	1073	UIntegerT	2		Read	0 .. 65535	d
Error Memory 3 Hour	V_Error_Memory_3_Hour	Error memory 3 hour in which the error occurred	1074	UIntegerT	2		Read	0 .. 24	h
Error Memory 3 Minute	V_Error_Memory_3_Minute	Error memory 3 minute in which the error occurred	1075	UIntegerT	2		Read	0 .. 1440	min
Error Memory 4 Error	V_Error_Memory_4_Error	Error memory 4 occurred error.	1076	UIntegerT	2		Read	Error code list; chapter 8	
Error Memory 4 Day	V_Error_Memory_4_Day	Error memory 4 day in which the error occurred	1077	UIntegerT	2		Read	0 .. 65535	d

Variable	Variable ID	Description	Index	Datatype	Bit	Code	R/W	Description value	Unit
Error Memory 4 Hour	V_Error_Memory_4_Hour	Error memory 4 hour in which the error occurred	1078	UIntegerT	2		Read	0 .. 24	h
Error Memory 4 Minute	V_Error_Memory_4_Minute	Error memory 4 minute in which the error occurred	1079	UIntegerT	2		Read	0 .. 1440	min
Error Memory 5 Error	V_Error_Memory_5_Error	Error memory 5 occurred error.	1080	UIntegerT	2		Read	Error code list; chapter 8	
Error Memory 5 Day	V_Error_Memory_5_Day	Error memory 5 day in which the error occurred	1081	UIntegerT	2		Read	0 .. 65535	d
Error Memory 5 Hour	V_Error_Memory_5_Hour	Error memory 3 hour in which the error occurred	1082	UIntegerT	2		Read	0 .. 24	h
Error Memory 5 Minute	V_Error_Memory_5_Minute	Error memory 5 minute in which the error occurred	1083	UIntegerT	2		Read	0 .. 1440	min
Error Memory 6 Error	V_Error_Memory_6_Error	Error memory 6 occurred error.	1084	UIntegerT	2		Read	Error code list; chapter 8	
Error Memory 6 Day	V_Error_Memory_6_Day	Error memory 6 day in which the error occurred	1085	UIntegerT	2		Read	0 .. 65535	d
Error Memory 6 Hour	V_Error_Memory_6_Hour	Error memory 6 hour in which the error occurred	1086	UIntegerT	2		Read	0 .. 24	h
Error Memory 6 Minute	V_Error_Memory_6_Minute	Error memory 6 minute in which the error occurred	1087	UIntegerT	2		Read	0 .. 1440	min
Error Memory 7 Error	V_Error_Memory_7_Error	Error memory 7 occurred error.	1088	UIntegerT	2		Read	Error code list; chapter 8	
Error Memory 7 Day	V_Error_Memory_7_Day	Error memory 7 day in which the error occurred	1089	UIntegerT	2		Read	0 .. 65535	d
Error Memory 7 Hour	V_Error_Memory_7_Hour	Error memory 7 hour in which the error occurred	1090	UIntegerT	2		Read	0 .. 24	H
Error Memory 7 Minute	V_Error_Memory_7_Minute	Error memory 7 minute in which the error occurred	1091	UIntegerT	2		Read	0 .. 1440	min
Error Memory 8 Error	V_Error_Memory_8_Error	Error memory 8 occurred error.	1092	UIntegerT	2		Read	Error code list; chapter 8	
Error Memory 8 Day	V_Error_Memory_8_Day	Error memory 8 day in which the error occurred	1093	UIntegerT	2		Read	0 .. 65535	d
Error Memory 8 Hour	V_Error_Memory_8_Hour	Error memory 8 hour in which the error occurred	1094	UIntegerT	2		Read	0 .. 24	h
Error Memory 8 Minute	V_Error_Memory_8_Minute	Error memory 8 minute in which the error occurred	1095	UIntegerT	2		Read	0 .. 1440	min
Error Memory 9 Error	V_Error_Memory_9_Error	Error memory 9 occurred error.	1096	UIntegerT	2		Read	Error code list; chapter 8	
Error Memory 9 Day	V_Error_Memory_9_Day	Error memory 9 day in which the error occurred	1097	UIntegerT	2		Read	0 .. 65535	d
Error Memory 9 Hour	V_Error_Memory_9_Hour	Error memory 9 hour in which the error occurred	1098	UIntegerT	2		Read	0 .. 24	h
Error Memory 9 Minute	V_Error_Memory_9_Minute	Error memory 9 minute in which the error occurred	1099	UIntegerT	2		Read	0 .. 1440	min
Error Memory 10 Error	V_Error_Memory_10_Error	Error memory 10 occurred error.	1096	UIntegerT	2		Read	Error code list; chapter 8	
Error Memory 10 Day	V_Error_Memory_10_Day	Error memory 10 day in which the error occurred	1097	UIntegerT	2		Read	0 .. 65535	d
Error Memory 10 Hour	V_Error_Memory_10_Hour	Error memory 10 hour in which the error occurred	1098	UIntegerT	2		Read	0 .. 24	h

Variable	Variable ID	Description	Index	Datatype	Bit	R/W	Description value	Unit
Error Memory 10 Minute	V_Error_Memory_10_Minute	Error memory 10 minute in which the error occurred	1099	UIntegerT	2	Read	0 .. 1440	min
V_Control_Word_Intern	V_Control_Word_Intern	internal control word to control the device state machine	1184	UIntergerT	2	Read	0..65535	
Status Word	V_Status_Word	Status word of the device state machine	1185	UIntergerT	2	Read	0..65535	
Setpoint Extern	V_Setpoint_Extern	External setpoint value (analogue)	1186	Float32T		Read	-120 .. 120	%
Setpoint Intern	V_Setpoint_Intern	Internal setpoint value (digital)	1187	Float32T		Read	-120 .. 120	%
Demand Value	V_Demand_Value	Demand value (processed setpoint value)	1188	Float32T		Read	-120 .. 120	%
Command Pilot Stage	V_Command_Pilot_Stage	Command signal for position of pilot spool	1189	Float32T		Read	-120 .. 120	%
Command Current	V_Command_Current	Command signal for current control	1191	Float32T		Read	-120 .. 120	%
Command PWM	V_Command_PWM	Command signal for PWM output	1192	Float32T		Read	-100 .. 100	%
Test Signal	V_Test_Signal	Test signal for device mode Test	1193	Float32T		Read	-100 .. 100	%
Actual Pilot Position	V_Actual_Pilot_Position	Actual position of the pilot stage	1194	Float32T		Read	-120 .. 120	%
Position Ctrl Pilot Output	V_Position_Ctrl_Pilot_Output	Output signal of pilot spool position controller	1204	Float32T		Read	-100 .. 100	%
Position Ctrl Pilot Ub	V_Position_Ctrl_Pilot_Ub	Output signal of pilot spool position bypass controller	1205	Float32T		Read	-30 .. 30	%
Position Ctrl Pilot Up	V_Position_Ctrl_Pilot_Up	Output signal of pilot spool position P-controller	1206	Float32T		Read	-10000 .. 10000	%
Position Ctrl Pilot Ui	V_Position_Ctrl_Pilot_Ui	Output signal of pilot spool position I-controller	1207	Float32T		Read	-100 .. 100	%
Position Ctrl Pilot Uv	V_Position_Ctrl_Pilot_Uv	Output signal of pilot spool position V-controller	1208	Float32T		Read	-10000 .. 10000	%
Position Ctrl Pilot Err	V_Position_Ctrl_Pilot_Err	Pilot spool position control error	1209	Float32T		Read	-200 .. 200	%
Actual Velocity Pilot Stage	V_Actual_Velocity_Pilot_Stage	Pilot spool velocity	1210	Float32T		Read	-200 .. 200	%
Actual Velocity Pilot Stage Filtered	V_Actual_Velocity_Pilot_Stage_Filtered	Pilot spool velocity filtered	1211	Float32T		Read	-200 .. 200	%
Current Ctrl Output	V_Current_Ctrl_Output	Output signal of current controller	1212	Float32T		Read	-100 .. 100	%
Current Ctrl Ub	V_Current_Ctrl_Ub	Output signal of current bypass controller	1213	Float32T		Read	-30 .. 30	%
Current Ctrl Up	V_Current_Ctrl_Up	Output signal of current P-controller	1214	Float32T		Read	-10000 .. 10000	%
Current Ctrl Ui	V_Current_Ctrl_Ui	Output signal of current I-controller	1215	Float32T		Read	-100 .. 100	%
Current Ctrl Err	V_Current_Ctrl_Err	Current control error	1216	Float32T		Read	-200 .. 200	%
Osci Chn 1 Signal Path	V_Osci_Chn_1_Signal_Path	Channel 1 signal path of the oscilloscope.	3516	UIntegerT	2	Read	1 = ACTUAL POSITION 2 = SETPOINT INTERN 3 = SETPOINT EXTERN 4 = SETPOINT BUS 5 = DMD VALUE 6 = CMD PILOTSTAGE 7 = CMD CURRENT 8 = TESTSIGNAL 9 = ACTUAL POS PILOTSTAGE 10 = ACTUAL CURRENT 11 = ACTUAL TEMP MCU 12 = ACTUAL TEMP LVDT 13 = ACTUAL VOLTAGE SUPPLY 14: POSCTRL PILOT OUTPUT 15 = POSCTRL PILOT ERR 16 = ACTUAL VEL PILOTSTAGE 17 = ACTUAL VEL PILOTSTAGE; FILTERED 18 = CURRENT CTRL OUTPUT 19 = CURRENT CTRL ERR 20 = PWM DUTY CYCLE 21 = ACTUAL POSITION RAW	

7. Description of functions

7.1 Valve setpoint

7.1.1 Offset

By setting the variable "Offset", a positive or negative value can be added to the target value. The offset is used to balance a hydraulic drive at setpoint 0 and open position control. The input refers to the 32-bit representation of the actual value.

7.1.2 Ramps

It is possible to influence the speed of the setpoint change via a ramp function. To do this, the ramp function must be activated with the variable "Ramp Type" – Index 284.

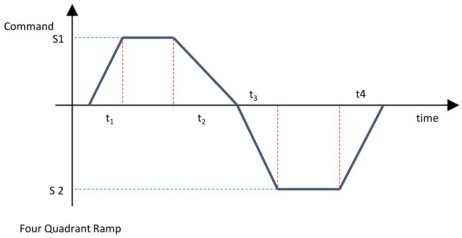
The rate of setpoint change can be influenced by the following variables:

- "Ramp Up Time Quadrant I" T1 Index 285
- "Ramp Down Time Quadrant I" T2 Index 286
- "Ramp UP Time Quadrant III" T3 Index 289
- "Ramp Down Time Quadrant III" T4 Index 290

The ramp function has 4 areas and thus 4 ramp slopes

1. The valve opens or opens further in the positive setpoint direction.
2. The valve closes in the positive setpoint range.
3. The valve opens or opens further into the negative setpoint range.
4. The valve closes in the negative setpoint range

The time basis for the ramp function is 1 millisecond (ms).



Four Quadrant Ramp

If the value of a variable is set to 0, the ramp function for that, ramp is disabled.

7.2 Stroke setting

7.2.1 Stroke setting - MIN

The minimum signal stroke can be adjusted in the range from 0 to 50% of the piston stroke. This setting can be set separately for both stroke directions of the valve piston. The setting is done using the variables "MIN A-Channel" and "MIN B-Channel".

Example:

MIN A-Channel - Index 278

Minimum value 0 % = 0

Maximum value 50% = 50

7.2.2 Stroke setting - MAX

The maximum signal stroke can be adjusted in the range of 51% to 100% from the piston stroke. This setting can be set separately for both stroke directions of the valve piston. The setting is done using the variables "MAX A-Channel" and "MAX B-Channel".

Beispiel:

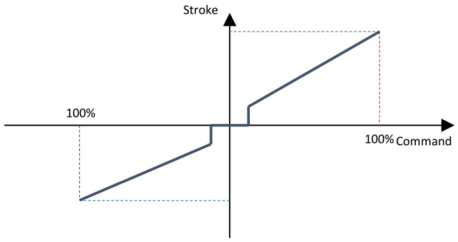
MAX-Channel - Index 281

Minimum value 51 % = 51

Maximum value 100% = 100

7.2.3 Overlap compensation

By setting the variables "MIN A-Channel" and "MIN B-Channel" it is possible to compensate for an existing overlap of the valve piston. If an overlap compensation has been set, it can be switched on or off via the variable "MIN Overlap Comp On/Off".



8 Device error information

8.1 Error list

Error Code	IO Link Description	Short description	Detailed description
0	No ERROR	no error	The device has not detected any error since the last Power-On or reset
4	UB HBRIDGE	No supply voltage on the actuator	
5	H BRIDGE UV WARN	Actuator under voltage warning	The supply voltage of the actuator is too low.
6	H BRIDGE OV WARN	Actuator over voltage warning	The supply voltage of the actuator is too high.
7	SIGNAL UV WARN	CPU under voltage warning	The supply voltage of the processor electronics is too low.
8	SIGNAL OV WARN	CPU over voltage warning	The supply voltage of the processor electronics is too high.
9	SIGNAL OV WARN	Temperature in housing too low -20°C	
10	TEMP INHOUSING TOO HIGH	Temperature in housing too high 85°C	
11	TEMP INHOUSING EXCEEDED	Temperature in housing exceeded 95°C	
12	TEMP INHOUSING FALLEN BELOW	Temperature in housing fallen below -30°C	
13	TEMP MCU TOO LOW	Electronics temperature too low (< –20 °C)	
14	TEMP MCU TOO HIGH	Electronics temperature too high (> 110 °C)	
15	TEMP MCU EXCEEDED	Electronics temperature exceeded (> 120 °C)	The unit temperature exceeded dangerously the permissible range.
16	OVERCURRENT ACTUATOR	Actuator over current	The current consumption of the actuator is too high.
19	FAULT_TEMP_MCU_FALLEN_BELOW	Interrupt overflow on CPU1	
	Interrupt noch nicht abgearbeitet when nächster kommt auf CPU1.		
20	BUS COM INTERRUPT	Interruption of the bus communication	Bus communication interrupted during controlling over bus.
21	BUS INVALID DATA	invalid data via the IO-Link bus	Invalid data about bus communication| The process data was set to "invalide" by the IO-Link master
22	FAULT_10V_REF_WARN	10V Reference voltage out of range 4%	The 10V reference voltage is 4% out of range.
23	FAULT_10V_REF_RANGE	10V Reference voltage out of range 10%	The 10V reference voltage is 10% out of range.
24	FAULT_2_5V_REF_WARN	2.5V Reference voltage out of range 4%	The 2.5V reference voltage is 4% out of range.
25	FAULT_2_5V_REF_RANGE	2.5V Reference voltage out of range 40%	The 2.5V reference voltage is 40% out of range.
26	CMD CABLE BREAK	Command signal cable break/short circuit	The wiring of command signal is short-circuited or interrupted.
27	ANALOG INPUT1 BREAK	Analog input 1 supply cable break/short circuit	The wiring at analogue input 1 is short-circuited or interrupted.
28	MAIN STAGE CABLE BREAK	Main stage supply cable break/short circuit	The wiring on analogue input 2 is short-circuited or interrupted.
29	TEMP LVDT TOO LOW	LVDT - oil temperature too low -20°C	LVDT - oil temperature too low -20°C
30	TEMP LVDT TOO HIGH	LVDT - oil temperature too high 75°C	LVDT - oil temperature too high 75°C
31	TEMP LVDT EXCEEDED	LVDT -oil temperature exceeded 85°C	LVDT - oil temperature exceeded 85°C
32	TEMP LVDT FALLEN BELOW	LVDT -oil temperature fallen below -30°C	LVDT - oil temperature fallen below -30°C
33	TEMP H BRIDGE TOO LOW	Temperature amplifier too low -20°C	
34	TEMP H BRIDGE TOO HIGH	Temperature amplifier too high 85°C	
35	TEMP H BRIDGE EXCEEDED	Temperature amplifier exceeded 95°C	
36	TEMP H BRIDGE FALLEN BELOW	Temperature amplifier fallen below -30°C	
37	TEMP POWERSUPPLY TOO LOW	Temperature power supply too low -20°C	
38	TEMP POWERSUPPLY TOO HIGH	Temperature power supply too high 85°C	
39	TEMP POWERSUPPLY EXCEEDED	Temperature power supply exceeded 95°C	
40	TEMP POWERSUPPLY FALLEN BELOW	Temperature power supply fallen below -30°C	
51	WATCHDOG	Software reset (watchdog) occurred	The watchdog has triggered, and the firmware has been restarted.
67	PILOT FAILSAFE	Pilot Fail-Safe monitoring	The valve spool has left the fail-safe range.
70	MAIN STAGE SENSOR POWER	Main-stage sensor missing/defective	
83	DRV L1 VDS	Actuator driver - Overcurrent Protection	The overcurrent protection of the Actuator driver has been activated. Contact Parker for more Information.
84	DRV H1 VDS	Actuator driver FET H1 Overcurrent Protection	The overcurrent protection of the Actuator driver has been activated. Contact Parker for more Information.
85	DRV L2 VDS	Actuator driver FET L2 Overcurrent Protection	The overcurrent protection of the Actuator driver has been activated. Contact Parker for more Information.
86	DRV H2 VDS	Actuator driver FET H2 Overcurrent Protection	The overcurrent protection of the Actuator driver has been activated. Contact Parker for more Information.

91	DRV TSD	Actuator driver Thermal Shutdown	The overtemperature shutdown of the Actuator driver has been activated.
93	FAULT_I2C_POWER_HBRIDGE	No or faulty I2C communication with power monitor of actuator driver	No or faulty I2C communication with power monitor of actuator driver.
94	FAULT_ I2C _POWER_SIGNAL	No or faulty I2C communication with power monitor of CPU electronics	No or faulty I2C communication with power monitor of CPU electronics.
95	FAULT_ I2C _TEMP_H_BRIDGE	No or faulty i2C communication with temperature sensor 0	No or faulty I2C communication with temperature sensor 0.
96	FAULT_ I2C _TEMP_POWERSUPPLY	No or faulty I2C communication with temperature sensor 1	No or faulty I2C communication with temperature sensor 1.
97	FAULT_ I2C _TEMP_INHOUSING	No or faulty I2C communication with temperature sensor 2	No or faulty I2C communication with temperature sensor 2.
118	FAULT_ZERO_DAC	Zero point DAC I2C communication fault	Zero point DAC I2C communication fault
119	FAULT_ I2C _TIMEOUT	I2C general fault	Internal I2C communication is disturbed.

8.2 Reaction on errors

The behaviour of the valve in the event of a fault can be adjusted by using the variable "Validate Error Reaction Type" index 768.

Procedure:

Step 1:

Index 769 – Validate Error Code – choose the error code.

Step 2:

Index 768 – Validate Error Reaction Type – set the reaction type for the chosen error type.

0 = no reaction
1 = Error is registered
2 = output of an error
3 = Disable
4 = Valve remains in the last position
5 = Error must be acknowledged

The last 10 errors can be retrieved via the variable "Validate Error Counter" index 770. The auto acknowledge of each error can be retrieved by the variable "Validate Auto Acknowledge"index 771.

9 Operating data

9.1 Operating hours

The operating time is recorded after the operating voltage is switched on, and the number of switch-on operations is recorded.

- "Operating Time Days" Index 800
- "Operating Time Hours" Index 801
- "Operating Time Minutes" Index 802
- "Operating Time Overall Minutes" Index 803
- "On Off Cycles" Index 805

9.2 Operating temperature

After switching on the operating voltage, various temperatures are recorded on the valve electronics. These are accessible via indices 831 to 846.

9.3 Diagnostics measuring point A

A wide variety of information can be retrieved via the variable "Diagnosis A Measuring Point" indice 268.

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MSG11-5715-752UK_Manual-Valves-IO-Link-Interface.indd 07.2026