I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI4110808**

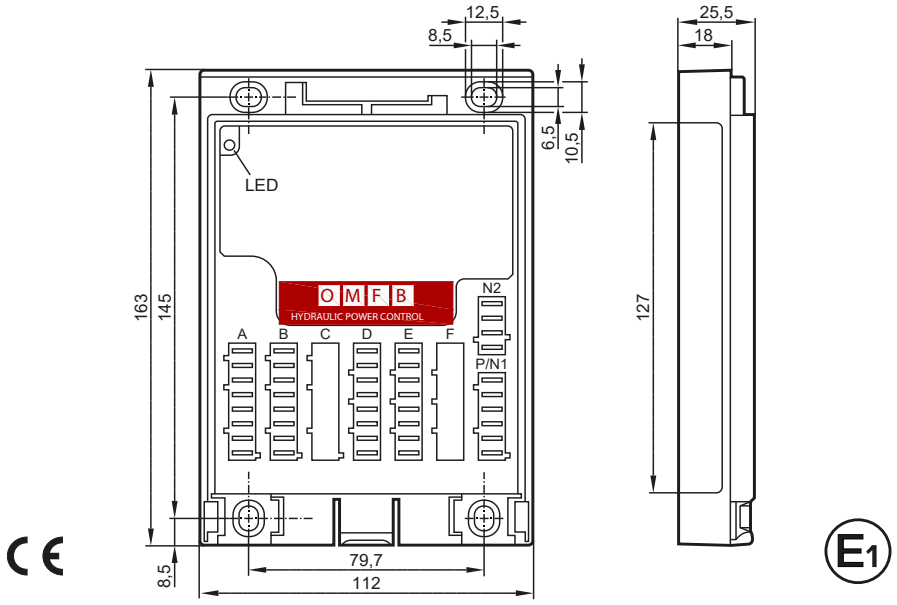
Mobile controller

8 inputs
8 outputs

2 CAN interfaces

Programming
to IEC 61131-3

8...32 V DC



Technical data	Modular control system Usable as CANopen master or intelligent I/O module
Mechanical data	
Housing	plastic housing (black)
Dimensions (H x W x D) without cover with EC0401 cover with EC0402 cover and BasicDisplay CR0451	163 x 112 x 25.5 mm 163 x 112 x 68 mm 163 x 112 x 73.4 mm
Installation	fixing by means of 4 M4 screws to DIN 912 or DIN 7984 and 4 tubular rivets to DIN 7340 (tubular rivets are supplied)
Connection	AMP blade male terminals 6.3 mm, to be clipped into place and thus vibrationresistant, protected against reverse polarity contacts AMP timer, CuZn pre-tin-plated core cross-section 0.5...2.5 mm²
Inputs Outputs Operating voltage , CAN bus	2 x 8-pole 2 x 8-pole 1 x 6-pole, 1 x 4-pole
Protection	IP 20 (with cover and cable seal IP 54)
Operating/storage temperature	-40...85° C / -40...85° C
Weight	0.30 kg
Electrical data	
Operating voltage	8...32 V DC
Current consumption	45 mA (at 24 V DC)
Overvoltage Undervoltage detection Undervoltage shutdown	36 V for t ≤ 10 s if U_B ≤ 7.8 V if U_B ≤ 7.0 V
Processor	Freescale PowerPC, 50 MHz
Memory (total)	592 Kbytes RAM / 1536 Kbytes Flash / 1 Kbyte FRAM
Memory allocation	see BasicController*plus* system manual www.ifm.com → Data sheet search → e.g. CR0411 → Additional data
Device monitoring	Undervoltage monitoring Watchdog function Checksum test for program and system Excess temperature monitoring

I/O controller for PDV Proportional valve - PHSI series
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Technical data

CAN interfaces 1/2	CAN interface 2.0 A/B, ISO 11898
Baud rate	20 Kbits/s...1 Mbit/s (default CAN1: 250 Kbits/s, CAN2: 250 Kbits/s)
Communication profi le	CANopen, CiA DS 301 version 4, CiA DS 401 version 1.4 or SAE J 1939 or free protocol
Software/programming	
Programming system	CODESYS version 2.3 (IEC 61131-3)
Inputs	8 (configurable)

Configurations

Number	Description	
4	digital for positive/negative sensor signals analogue (0...10/32 V DC, 0...20 mA, ratiometric) frequency (≤ 30 kHz)	B_L/B_H A FRQ
4	digital for positive sensor signals resistance measurement (0.016...30 kΩ)	B_L R

positive sensor signals have diagnostic capabilities

Outputs	8 (configurable)

Configurations

Number	Description	
4	positive switching (high side) PWM output (20…250 Hz), 2.5 A, current-controlled, 0.02…2.5 A, diagnosis	BH PWM PWM-I
4	positive switching (high side) negative switching (low side), 4 A PWM output (20…250 Hz), 4 A, diagnosis current-controlled, 0.02…4 A, diagnosis H-bridge function	BH B_L PWM PWM-I H bridge

Status LED	two-colour LED (red/green)

Operating states (preset)

Colour	Status	Description
–	permanently off	no operating voltage
orange	1 x on	initialisation or reset checks
green	5 Hz	no operating system loaded
	2 Hz	application running (RUN)
	permanently on	application stopped (STOP)
Red	10 Hz	application stopped (STOP with error)
	5 Hz	application stopped due to undervoltage
	permanently on	system error (fatal error)

Abbreviations

A	Analogue
BH	Binary high side
BL	Binary low side
FRQ	Frequency/pulse inputs
H	H-bridge function
PWM	Pulse width modulation
PWM-I	Pulse width modulation, current-controlled
R	Resistor input
VBBS	Supply sensors/module
VBB1	supply OUT 0...3
VBB2	supply OUT 4...7

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI4110808**

Technical data

Input characteristics

Analogue inputs (A, B_L/B_H, FRQ)
Connection A: 02, 03, 06, 07
IN0...IN3 can be confi gured as...

● Voltage inputs	
Input voltage	0...10 V or 0...32 V
Resolution	12 bits
Accuracy	± 1% FS
Input resistance	65.6 kΩ (0...10 V), 50.7 kΩ (0...32 V)
Input frequency	≤ 500 Hz
● current inputs, with diagnostic capability	
Input current	0...20 mA
Resolution	12 bits
Accuracy	± 1% FS
Input resistance	400 Ω
Input frequency	≤ 500 Hz
At a current of > 23 mA the input is switched to the voltage input!	
● Voltage inputs, 0...32 V, ratiometric	
Function	(U_{IN} ÷ U_B) x 1000 ‰
Value range	0...1000 ‰
Input resistance	50.7 kΩ
● Binary voltage inputs for positive sensor signals	
Switch-on level	> 0.7 U_B
Switch-off level	< 0.3 U_B
Input resistance	3.2 kΩ
Input frequency	50 Hz
Diagnosis wire break	> 0.95 U_B
Diagnosis short circuit	< 1 V
● Binary voltage inputs for negative sensor signals	
Switch-on level	> 0.7 U_B
Switch-off level	< 0.3 U_B
Input resistance	3.2 kΩ
Input frequency	50 Hz
● Frequency inputs	
Input resistance	3.2 kΩ
Input frequency	≤ 30 kHz
Switch-on level	> 0.35...0.48 U_B
Switch-off level	< 0.29 U_B

Digital/resistor inputs (B_L, R)
Connection B: 02, 03, 06, 07
IN4…IN7
can be confi gured as…

● Binary voltage inputs for positive sensor signals	
Switch-on level	> 0.7 U_B
Switch-off level	< 0.3 U_B
Input resistance	3.2 kΩ
Input frequency	50 Hz
Diagnosis wire break	> 0.95 U_B
Diagnosis short circuit	< 1 V
● Resistor input	
Measuring current	< 2.0 mA
Input frequency	50 Hz
Measuring range	0.016…30 kΩ
Accuracy	± 2 % FS: 16 Ω...3 kΩ ± 5 % FS: 3...15 kΩ ± 10 % FS: 15...30 kΩ
Diagnosis	> 31 kΩ
Diagnosis short circuit	to VBB

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI4110808**

Technical data

Output characteristics

Digital outputs (B_H, PWM, PWM-I)

Connection D: 01, 03, 05, 07
OUT0…OUT3

● Semiconductor outputs, positive-switching (high side) Short-circuit proof and overload protected Diagnosis via current feedback (wire break / overload) Diagnosis via voltage feedback, pullup resistance can be deactivated (wire break/ short circuit)	
Switching voltage	5.5...32 V DC
Switching current	≤ 2.5 A
Load resistance	≥ 4.8 Ω (at 12 V DC) ≥ 9.6 Ω (at 24 V DC)
● PWM outputs	
Output frequency	20...250 Hz
Pulse/pause ratio	1…1000 ‰
Switching current	≤ 2.5 A
● Current-controlled output	
Output frequency	20...250 Hz
Control range	0.02…2.5 A
Setting resolution	1 mA
Control resolution	2 mA

Max. ambient temperature in PWM mode: ≤ 70 °C

Max. switch-on current	≤ 24 A

Digital outputs ($B_{H/L}$, PWM, PWM-I, H)

Connection E: 01, 03, 05, 07
OUT4…OUT7

● Semiconductor outputs, positive-switching (high side), negative switching (low side), short-circuit and overload protection Diagnosis via current feedback (wire break / overload) Diagnosis via voltage feedback, pullup resistance can be deactivated (wire break/ short circuit)	
Switching voltage	5.5...32 V DC
Switching current	≤ 4 A
Max. clamp energy	< 3 J (at 25°C)
Load resistance	≥ 3 Ω (at 12 V DC) ≥ 6 Ω (at 24 V DC)
● PWM outputs	
Output frequency	20...250 Hz
Pulse/pause ratio	1…1000 ‰
Switching current	≤ 4 A
● current-controlled output	
Output frequency	20...250 Hz
Control range	0.02…4 A
Setting resolution	1 mA
Control resolution	2 mA

Max. ambient temperature in PWM mode: ≤ 70 °C

Max. switch-on current	≤ 24 A (high side) ≤ 16 A (low side)

Free wheel diodes	Free wheel diodes for the deactivation of inductive loads are integrated
Overload protection (valid for all outputs)	≤ 5 minutes (at 100% overload)
Short-circuit strength (valid for all inputs and outputs)	≤ 5 minutes (contacts +VBB/GND)
Total current per output supply VBB_1 or VBB_2	≤ 8 A

Technical data		
Total summation current of the output supply VBB_1 and VBB_2 (continuous current load)	≤ 12 A	
Test standards and regulations		
CE marking	EN 61000-6-2	Electromagnetic compatibility (EMC) Noise immunity
	EN 61000-6-4	Electromagnetic compatibility (EMC) Emission standard
E1 marking	UN/ECE-R10	Emission standard Immunity with 100 V/m
Electrical tests	ISO 7637-2	Pulse 1, severity level: IV; function state C Pulse 2a, severity level: IV; function state A Pulse 2b, severity level: IV; function state C Pulse 3a, severity level: IV; function state A Pulse 3b, severity level: IV; function state A Pulse 4, severity level: IV; function state B Pulse 5, severity level: III; function state C (data valid for the 24 V system) Pulse 4, severity level: III; function state C (data valid for the 12 V system)
Climatic tests	EN 60068-2-30	Damp heat, cyclic Upper temperature 55°C, number of cycles: 6
	EN 60068-2-78	Damp heat, steady state Test temperature 40°C / 93% RH, Test duration: 21 days
	EN 60068-2-52	Salt spray test Severity level 3 (vehicle) Only with installed EC0401 or EC0402 cover
Mechanical tests	ISO 16750-3	Test VII; Vibration, random Mounting location: vehicle body
	EN 60068-2-6	Vibration, sinusoidal 10...500 Hz; 0.72 mm/10 g; 10 cycles/axis
	ISO 16750-3	Bumps 30 g/6 ms; 24,000 shocks
Tests for railway applications	EN 50121-3-2	Electromagnetic compatibility (EMC)
	EN 50155 clause 12.2	Electronic equipment used on rolling stock

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI4110808**

Technical data

Wiring

A	B	C	D	E	F	N2	P/N1
8 poles						4 poles	6 poles
VBBs IN0 IN1 GND GND IN2 IN3 VBBs	VBBs IN4 IN5 GND GND IN6 IN7 VBBs		OUT0 GND OUT1 GND OUT2 GND OUT3 GND	OUT4 GND OUT5 GND OUT6 GND OUT7 GND		VBBs GND CAN2_H CAN2_L	VBBs VBB1 VBB2 GND CAN1_H CAN1_L

C/F = not used

A	Analogue
Bh	Binary hight side
BL	Binary low side
FRQ	Frequency/pulse inputs
H	H-bridge function
PWM	Pulse width modulation
PWM-I	Pulse width modulation, current-controlled
R	Resistor input
VBBs	Supply sensor/module
VBB1	Supply OUT 0…3
VBB2	Supply OUT 4…7

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI7101008**

IEC 61508:2010 SIL 2
IEC 62061:2005 + A1:2012 + A2:2015 SIL CL 2
if used as safety controller
Suited for requirements up to:
PL d (ISO 13849-1:2015)
AgPL d(ISO 25119:2018,
DIN EN 16590:2014)

32-bit CPU TriCore processor

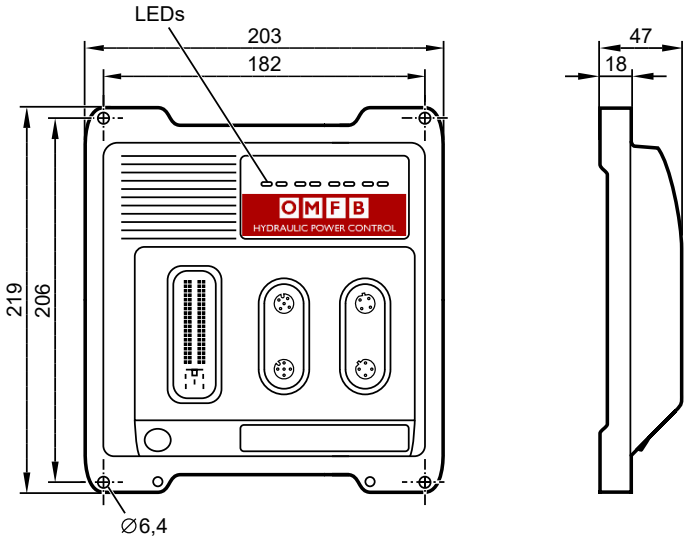
37 inputs/outputs

4 CAN interfaces

Ethernet interface

CODESYS 3.5

8...32 V DC



CE E1

Technical data	Controller as a black-box system for the implementation of a central or decentralised system design
Mechanical data	
Housing	closed, screened metal housing with screw fixing
Dimensions (H x W x D)	219 x 203 x 47 mm
Installation	fixing with 4 M6 screws
Connection	1 connector 81 poles, locked, mechanical reverse polarity protection type Tyco / AMP AMP junior timer contacts, crimp connection 0.5/0.75/2.5 mm² 2 M12 connectors, 4 poles, D-coded 2 M12 connectors, 5 poles, A-coded shield connection Ø 4 mm for self-tapping Screw
Weight	1.4 kg
Housing/storage temperature	-40...85 °C / -40...85 °C
Max. perm. relative humidity	90 % (not condensing)
Height above sea level	max. 3000 m
Degree of soiling	2
Protection rating	IP 65 / IP 67 (for inserted connectors with individually sealed cores and inserted M12 connectors/sealing caps)
Electrical data	
Input/output channels, total	37 (20 inputs / 17 outputs)
Inputs	configurable, with diagnostic capability 8 x A (0...10/32 V, 0...20 mA, ratiometric) / B_L 8 x $FRQ_{L/H}$ (≤ 30 kHz) / $B_{L/H}$ 4 x R (0.016...30 kOhm) / B_L

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI7101008**

Technical data	
Outputs	configurable, with diagnostic capability 4 x $PWM_{H/L}$ / PWM_I / $B_{H/L}$ (20...2000 Hz, 4.0 A, H-bridge) 6 x PWM_H / PWM_I / B_H (20...2000 Hz, 2.5 A) 6 x PWM_H / B_H 2.5 A 1 x A (0...10 V)
Sensor supply	1 x 0/5/10 V, max. 2 W configurable
	for the number of inputs/outputs of the inputs and outputs also see the wiring diagrams
Operating voltage	8...32 V DC
Overvoltage	36 V for t ≤ 10 s
Reverse polarity protection	yes, in case of supply via the on-board system (battery)
Power consumption VBB_{30}	8 W
CAN interfaces 0...3	CAN interface 2.0 A/B, ISO 11898
Baud rate	20 kbit/s...1 Mbit/s (default 250 kbit/s)
Communication profile	CANopen, CiA DS 301 V4.2, CiA DS 401 V1.4 / SAE J 1939 / free protocol CANopen Safety for safe data transmission
Serial interface	RS-232
Baud rate	9.6...115.2 kbit/s (default 115.2 kbit/s)
Topology	point-to-point (max. 2 participants); master-slave connection
Ethernet interface	1 interface with integrated switch and 2 ports
Transmission rate	10/100 Mbit/s
Protocols	TCP/IP, UDP/IP, Modbus UDP
Processor	32-bit TriCore CPU Infineon AURIX™
Device monitoring	overvoltage and undervoltage monitoring watchdog function (extended safety monitoring according to IEC 62061 and ISO 13849) check sum test for program and system excess temperature monitoring
Process monitoring concept	second switch-off way per output group via semiconductor switch
Physical memory	flash: 9 MBytes RAM: 2.7 MBytes non-volatile memory: 10 kBytes
Memory allocation	Memory can be allocated for safe and non-safe applications see programming manual www.ifm.com
Software/programming	
Programming system	CODESYS version 3.5 with SIL 2 extension (IEC 61131-3)
Light indicators	
Status LED	2 x two-colour LED (R/G) for SYS0 and SYS1
Ethernet LED	2 x LED (G) for ETH0 and ETH1
Application LED	4 x three-colour LED (R/G/B) for APP0, APP1, APP2 and APP3, programmable

Technical data

Operating states system

LED SYS0		LED SYS1		System state
Colour	Status	Colour	State	
–	off	–	off	no operating voltage
green	5 Hz	–	off	no operating system loaded
red	on	–	off	hardware error (fatal error+)
red	on	red	on	system error (fatal error)
green/ yellow	2 Hz	green/ yellow	2 Hz	update

Operating states PLC/application

LED	Colour	Status		Description
SYS0	green	on	Standard PLC	no application
		2 Hz		run
	red	10 Hz		error application (serious error)
	yellow	2 Hz		debug run
		on		debug stop
SYS1	green	on	Safety PLC	no application
		2 Hz		run
	red	10 Hz		error application (serious error)
	yellow	2 Hz		debug run
		on		debug stop
ETH0	green	flashing		data transmission Ethernet
		on		Ethernet connection ok, no data transmission
ETH1	green	flashing		data transmission Ethernet
		on		Ethernet connection ok, no data transmission
APP0	red	on		status display of the application, freely programmable
...	green	on		status display of the application, freely programmable
APP3	blue	on		status display of the application, freely programmable

Safety-related characteristics

Safety Integrity Level Claim Limit	SIL CL	2

Component	PFH_D [1/h]
Input, external, single channel	$<4.0 \times 10^{-9}$
Input, external, dual channel	$<5.0 \times 10^{-10}$
Logic	$<1.0 \times 10^{-7}$
Output, external, single channel	$<2.0 \times 10^{-8}$
Output, external, dual channel	$<1.0 \times 10^{-9}$

Lifetime: 20 years

Technical data		
Test standards and regulations		
CE mark	EN IEC 62061	Safety of machinery - Functional safetyof electrical, electronic and programmable safety-related control systems
	EN 61000-6-2	Electromagnetic compatibility (EMC) Immunity
	EN 61000-6-4	Electromagnetic compatibility (EMC) Emission
	EN 61010	Safety requirements for electrical equipment for measurement, control and laboratory use
E1 mark	UN/ECE-R10	Noise emission Noise immunity with 100 V/m
Electrical tests	ISO 7637-2	Pulse 1, severity level: IV; function state C Pulse 2a, severity level: IV; function state A Pulse 2b, severity level: IV; function state C Pulse 3a, severity level: IV; function state A Pulse 3b, severity level: IV; function state A Pulse 4, severity level: IV; function state A Pulse 5, severity level: III; function state A (data valid for the 24 V system) Pulse 4, severity level: III; function state A (data valid for the 12 V system)
Climatic tests	EN 60068-2-30	Damp heat, cyclic Upper temperature 55 °C, number of cycles: 6
	EN 60068-2-78	Damp heat, steady state Test temperature 40 °C / 93 % RH Test duration: 21 days
	EN 60068-2-52	Salt spray test Severity level 3 (vehicle)
Mechanical tests	ISO 16750-3	Test VII; vibration, random Mounting location: vehicle body
	EN 60068-2-6	Vibration, sinusoidal 10...500 Hz; 0.72 mm/10 g; 10 cycles/axis
	ISO 16750-3	Bump 30 g/6 ms; 24,000 shocks
Safety-related tests	IEC 61508 parts 1-7	Functional safety of electrical/electronic/programmable electronic safety-related systems
	EN 62061	Safety of machinery - Functional safety of electrical, electronic and programmable safety-related control systems
Chemical resistance	ISO 16750-5	AA, BA, BD, CC, DB, DC, DD, only one chemical permitted at a time

ST A / input characteristics

ST A:

IN0100...0103
IN0600...0603

Multifunction inputs analogue / digital
(IN MULTIFUNCTION-A)

Resolution	12 bits
Input frequency	< 330 Hz
Measuring ranges	0...10 V, 0...32 V, 0...20 mA, ratiometric, binary low side
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Current input 0 … 20 mA (A)

Input resistance	298 Ω
Range diagnostics min./max.	0 mA / 20 mA (default)
Accuracy	± 1.5 % FS

Voltage input 0...10 V (A)

Input resistance	67.6 kΩ
Range diagnostics min./max.	0 V / 10 V (default)
Accuracy	± 1 % FS

Voltage input 0...32 V (A)

Input resistance	51.0 kΩ
Range diagnostics min./max.	0 V / 32 V (default)
Accuracy	± 1 % FS

Voltage input ratiometric (A)

Input resistance	51.0 kΩ
Range diagnostics min./max.	0 ‰ / 1000 ‰ (default)
Accuracy	± 1 % FS

Digital input (B_L)
(default)

Input resistance	9.5 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)
Accuracy	± 1 % FS

ST A:

IN0000...0003
IN0500...0503

Digital inputs, frequency measurement
(IN FREQUENCY-B)

Resolution	12 bits

Frequency input ($FRQ_{L/H}$)

Input resistance	10 kΩ
Input frequency	≤ 30 kHz
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy	± 10 µs

ST A / input characteristics

Digital input ($B_{L/H}$)
(default: B_L)

Input resistance	10 kΩ
Input frequency	< 330 Hz
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L / B_H	± 1 % FS / ± 3 % FS
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

ST A:

IN0400...0401
IN0900...0901

Digital/ resistor inputs (IN RESISTOR-B)

Resolution	12 bits
Input frequency	< 330 Hz
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Digital input (B_L)
(default)

Input resistance	3.2 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

Resistor input (R)

Measuring current	< 2.0 mA
Measuring range	0.016...30 kΩ
Accuracy	± 2 % FS: 0.016...3 kΩ ± 5 % FS: 3...15 kΩ ± 10 % FS: 15...30 kΩ
Range diagnostics min./max.	0 Ω / 31 kΩ (default)

RESET-COM

Switch-on level	> 0,7 VBB_{30}
Switch-off level	< 0,3 VBB_{30}
Accuracy	± 5 % FS

Observe the notes on the configuration of the inputs/outputs!

Abbreviations

A analogue
B_H binary high side (CSO)
B_L binary low side (CSI)
$FRQ_{L/H}$ frequency/pulse inputs configurable low side (CSI) / high side (CSO)
PWM_H pulse width modulation high side (CSO)
PWM_L pulse width modulation low side (CSI)
PWM_I pulse width modulation current-controlled
R resistor input
$VBB_{0/1}$ $VBB_{0/1}$ supply
output group VBB_{30}
supply controller

ST A / output characteristics

ST A:

OUT0006...0007
OUT0106...0107

Digital / PWM outputs
4.0 A, H-bridge
(OUT PWM-40-BRIDGE-A)

Switching current	0.025...4 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND according to the programming manual detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_H) (default)

Switching voltage	8...32 V DC
Range diagnostics min./max.	0 A / 4 A (default)

Digital output (B_L)

Functions	as H-bridge

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 4 A (default)

PWM output (PWM_L)

Output frequency	20...500 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)

Current-controlled output (PWM_I)

Output frequency	20...2000 Hz (per channel)
Control range	0.,05...4 A
Setting resolution	1 mA
Control resolution	2 mA
Load resistance	≥ 3 Ω (at 12 V DC) ≥ 6 Ω (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 4 A (default)

ST A / output characteristics

ST A:

OUT0000
OUT0002
OUT0004
OUT0100
OUT0102
OUT0104

Digital / PWM outputs 2.5 A (OUT PWM-25-A)

Digital output (B_H) (default)

Switching voltage	8...32 V DC
Switching current	0.025...2.5 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Range diagnostics min./max.	0 A / 2.5 A (default)

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 2.5 A (default)

Current-controlled output (PWM_I)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...2,5 A
Setting resolution	1 mA (at 20...250 Hz)
Control resolution	2 mA
Load resistance	≥ 4.8 Ω (at 12 V DC) ≥ 9.6 Ω (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A:

OUT0001
OUT0003
OUT0005
OUT0101
OUT0103
OUT0105

Digital outputs 2.5 A (OUT PWM-25-B)

Digital output (B_H) (default)

Switching voltage	8...32 V DC
Switching current	0.025...2.5 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	5 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Range diagnostics min./max.	0 A / 2.5 A (default)

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ FS (at 20...250 Hz)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A / output characteristics

ST A:

OUT3000

Sensor supply (OUT SUPPLY-A)

for sensors and joysticks
0 V, / 5 V, 400 mA / 10 V, 200 mA, accuracy ± 5 %
minimum current 10 mA
short-circuit proof and overload protected

ST A:

OUT3001

Analogue outputs (OUT VOLTAGE-A)

Current rating	< 5 mA
Output voltage	0...10 V
Accuracy	± 5 % FS
Step response time 10...90 %	< 1.8 ms

Output groups $VBB_{0/1}$

Load current per output group: ≤ 12 A

Internal semiconductor switches: One switch in series of 8 semiconductor outputs each
Forced controlling by means of hardware
and additional controlling by means of user program

Switching current	0.1...12 A
Current diagnostics (excessive current)	> 12 A

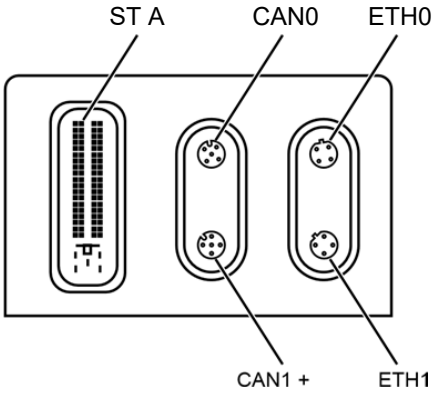
Short-circuit strength to GND: Outputs are switched off via the output driver

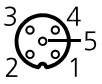
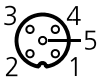
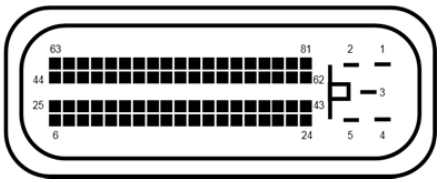
Abbreviations

A	analogue
B_H	binary high side (CSO)
B_L	binary low side (CSI)
PWM_H	pulse-width modulation high side (CSO)
PWM_L	pulse-width modulation low side (CSI)
PWM_I	pulse-width modulation current-controlled
$VBB_{0/1}$	supply output group
VBB_{30}	supply controller

Technical data

Connectors

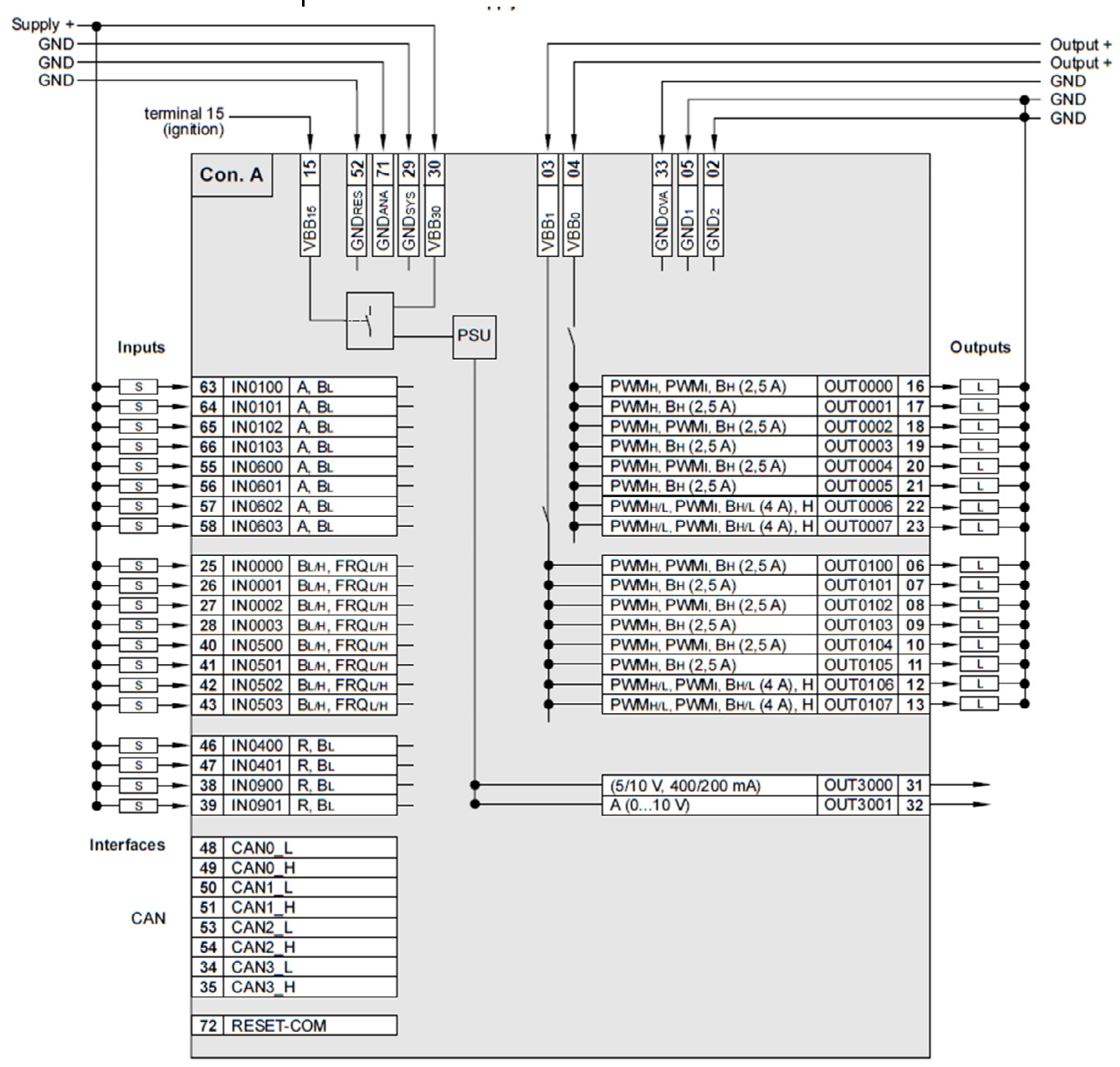


CAN0	M12 socket, 5 poles, A-coded 1: not used 2: not used 3: GND_COM 4: CAN0_H 5: CAN0_L 
CAN1 + RS-232	M12 socket, 5 poles, A-coded 1: RS-232_TxD 2: RS-232_RxD 3: GND_COM 4: CAN1_H 5: CAN1_L 
ETH0 / ETH1	M12 socket, 4 poles, D-coded 1: TxD+ 2: RxD+ 3: TxD- 4: RxD- 
ST A	AMP, 81 poles, A-coded 1-81: see wiring ST A 

Technical data

Wiring

ST A



Abbreviations

A	analogue
B_H	binary high side (CSO)
B_L	binary low side (CSI)
$FRQ_{L/H}$	frequency/pulse inputs configurable low side (CSI) / high side (CSO)
H	H-bridge function
PSU	power supply for the system
PWM_H	pulse-width modulation high side (CSO)
PWM_L	pulse-width modulation low side (CSI)
PWM_I	pulse-width modulation current-controlled
R	resistor input
$VBB_{0/1}$	supply output group
VBB_{30}	supply controller

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI7111816**

IEC 61508:2010 SIL 2
IEC 62061:2005 + A1:2012 + A2:2015 SIL CL 2
if used as safety controller
Suited for requirements up to:
PL d (ISO 13849-1:2015)
AgPL d(ISO 25119:2018,
DIN EN 16590:2014)

32-bit CPU TriCore processor

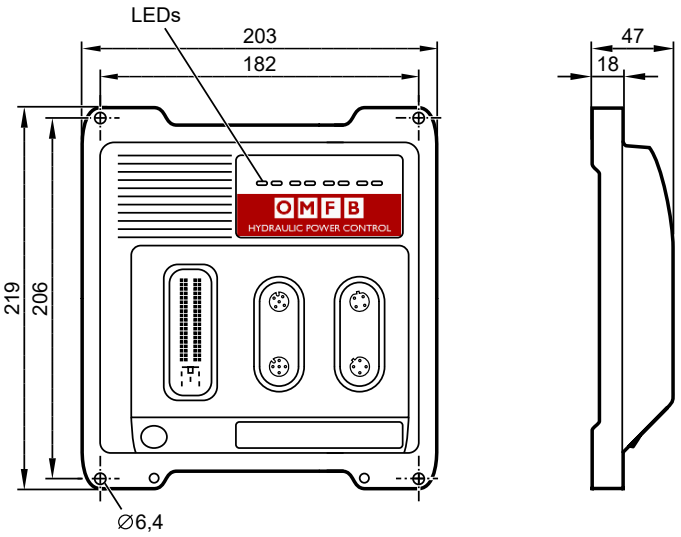
60 inputs/outputs

4 CAN interfaces

Ethernet interface

CODESYS 3.5

8...32 V DC



CE

E1

Technical data	Controller as black box system_for the implementation of a central or decentralised system design
Mechanical data	
Housing	closed, screened metal housing with screw fixing
Dimensions (H x W x D)	219 x 203 x 47 mm
Installation	fixing with 4 M6 screws
Connection	1 connector 81 poles, locked, mechanical reverse polarity protection type Tyco / AMP AMP junior timer contacts, crimp connection 0.5/0.75/2.5 mm² 2 x M12 connectors, 4 poles, D-coded 2 x M12 connectors, 5 poles, A-coded shield connection Ø 4 mm for self-tapping screw
Weight	1.4 kg
Housing/storage temperature	-40...85 °C / -40...85 °C
Max. perm. relative humidity	90 % (not condensing)
Height above sea level	max. 3000 m
Degree of soiling	2
Protection rating	IP 65 / IP 67 (for inserted connectors with individually sealed cores and inserted M12 connectors/sealing caps)
Electrical data	
Input/output channels total	60 (32 inputs / 28 outputs)
Inputs	configurable, with diagnostic capability 16 x A (0...10/32 V, 0...20 mA, ratiometric) / B_L 8 x $FRQ_{L/H}$ (≤ 30 kHz) / $B_{L/H}$ 4 x R (0.016...30 kOhm) / B_L 4 x B_L (impedance ≤ 3.2 kOhm)

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI7111816**

Technical data	
Outputs	configurable, with diagnostic capability 6 x $PWM_{H/L}$ / PWM_I / $B_{H/L}$ (20...2000 Hz, 4.0 A, H-bridge) 3 x PWM_H / PWM_I / B_H (20...2000 Hz, 4.0 A) 9 x PWM_H / PWM_I / B_H (20...2000 Hz, 2.5 A) 9 x PWM_H / B_H 2.5 A 1 x A (0...10 V)
Sensor supply	1 x 0/5/10 V, max. 2 W configurable
	for the number of inputs/outputs of the inputs and outputs also see the wiring diagrams
Operating voltage Overvoltage	8...32 V DC 36 V for t ≤ 10 s
Reverse polarity protection	yes, in case of supply via an on-board system (battery)
Power consumption VBB_{30}	8 W
CAN interfaces 0...3 Baud rate Communication profile	CAN interface 2.0 A/B, ISO 11898 20 kbits/s...1 Mbit/s (default 250 kbits/s) CANopen, CiA DS 301 V4.2, CiA DS 401 V 1.4 / SAE J 1939 / free protocol CANopen Safety for safe data transmission
Serial interface Baud rate Topology	RS-232 9.6...115.2 Kbits/s (default 115.2 Kbits/s) point-to-point (max. 2 participants); master-slave connection
Ethernet interface Transmission rate Protocols	1 interface with integrated switch and 2 ports 10/100 Mbits/s TCP/IP, UDP/IP, Modbus UDP
Processor	32-bit TriCore CPU Infineon AURIX™
Device monitoring	overvoltage and undervoltage monitoring watchdog function (extended safety monitoring according to IEC 62061 and ISO 13849) check sum test for program and system excess temperature monitoring
Process monitoring concept	second switch-off way per output group via semiconductor switch
Physical memory	flash: 9 MBytes RAM: 2.7 MBytes non-volatile memory: 10 KBytes
Memory allocation	Memory can be allocated for safe and non-safe applications see programming manual www.ifm.com
Software/programming	
Programming system	CODESYS version 3.5 with SIL 2 extension (IEC 61131-3)
Light indicators	
Status LED	2 x two-colour LED (R/G) for SYS0 and SYS1
Ethernet LED	2 x LED (G) for ETH0 and ETH1
Application LED	4 x three-colour LED (R/G/B) for APP0, APP1, APP2 and APP3, programmable

Technical data

Operating states of the system

LED SYS0		LED SYS1		System state
Colour	Status			
–	off	-	off	no operating voltage
green	5 Hz	-	off	no operating system loaded
red	on	-	off	hardware error (fatal error+)
red	on	red	on	system error (fatal error)
green / yellow	2 Hz	green / yellow	2 Hz	update

Operating states PLC/application

LED	Colour	Status	Description	
SYS0	green	on	Standard PLC	no application
		2 Hz		run
	red	10Hz		error application (serious error)
	yellow	2 Hz		debug run
		on		debug stop
SYS1	green	on	Safety PLC	no application
		2 Hz		run
	red	10Hz		error application (serious error)
	yellow	2 Hz		debug run
		on		debug stop
ETH0	green	flashing	data transmission Ethernet	
		on	Ethernet connection ok, no data transfer	
ETH1	green	flashing	data transmission Ethernet	
		on	Ethernet connection ok, no data transfer	
APP0 ... APP3	red	on	status display of the application, freely programmable	
	green	on	status display of the application, freely programmable	
	blue	on	status display of the application, freely programmable	

Safety-related characteristics

Safety Integrity Level Claim Limit	SIL CL	2

Component	PFH_D [1/h]
Input, external, single channel	$< 4.0 \times 10^{-9}$
Input, external, dual channel	$< 5.0 \times 10^{-10}$
Logic	$<1.0 \times 10^{-7}$
Output, external, single channel	$< 2.0 \times 10^{-8}$
Output, external, dual channel	$< 1.0 \times 10^{-9}$

Lifetime: 20 years
Other characteristic values: see SISTEMA library at ifm.com for download

Technical data		
Test standards and regulations		
CE mark	EN IEC 62061	Safety of machinery - Functional safety of electrical, electronic and programmable safety-related control systems
	EN 61000-6-2	Electromagnetic compatibility (EMC)
	EN 61000-6-4	Electromagnetic compatibility (EMC) Emission
	EN 61010	Safety requirements for electrical equipment for measurement, control and laboratory use
E1 mark	UN/ECE-R10	Noise emission Noise immunity with 100 V/m
Electrical tests	ISO 7637-2	Pulse 1, severity level: IV; function state C Pulse 2a, severity level: IV; function state A Pulse 2b, severity level: IV; function state C Pulse 3a, severity level: IV; function state A Pulse 3b, severity level: IV; function state A Pulse 4, severity level: IV; function state A Pulse 5, severity level: III; function state A (data valid for the 24 V system) Pulse 4, severity level: III; function state A (data valid for the 12 V system)
Climatic tests	EN 60068-2-30	Damp heat, cyclic Upper temperature 55 °C, number of cycles: 6
	EN 60068-2-78	Damp heat, steady state Test temperature 40°C / 93% RH, test duration: 21 days
	EN 60068-2-52	Salt spray test Severity level 3 (vehicle)
Mechanical tests	ISO 16750-3	Test VII; vibration, random Mounting location: vehicle body
	EN 60068-2-6	Vibration, sinusoidal 10...500 Hz; 0.72 mm/10 g; 10 cycles/axis
	ISO 16750-3	Bump 30 g/6 ms; 24,000 shocks
Safety-related tests	IEC 61508	parts 1-7 Functional safety of electrical/electronic/programmable electronic safety-related systems
	EN 62061	Safety of machinery - Functional safety of electrical, electronic and programmable safety- related control systems
Chemical resistance	ISO 16750-5	AA, BA, BD, CC, DB, DC, DD, Only one chemical permitted at a time

ST A / input characteristics

ST A:

IN0100...0103
IN0200...0203
IN0600...0603
IN0700...0703

Multifunction inputs analogue / digital
(IN MULTIFUNCTION-A)

Resolution	12 bits
Input frequency	< 330 Hz
Measuring ranges	0...10 V, 0...32 V, 0...20 mA, ratiometric, binary low side
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Current input 0 … 20 mA (A)

Input resistance	298 Ω
Range diagnostics min./max.	0 mA / 20 mA (default)
Accuracy	± 1.5 % FS

Voltage input 0...10 V (A)

Input resistance	67.6 kΩ
Range diagnostics min./max.	0 V / 10 V (default)
Accuracy	± 1% FS

Voltage input 0...32 V (A)

Input resistance	51.0 kΩ
Range diagnostics min./max.	0 V / 32 V (default)
Accuracy	± 1% FS

Voltage input ratiometric (A)

Input resistance	51.0 kΩ
Range diagnostics min./max.	0 ‰ / 1000 ‰ (default)
Accuracy	± 1% FS

Digital input (B_L)
(default)

Input resistance	9.5 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)
Accuracy	± 1% FS

ST A:

IN0000...0003
IN0500...0503

Digital inputs, frequency measurement
(IN FREQUENCY-B)

Resolution	12 bits

Frequency input ($FRQ_{L/H}$)

Input resistance	10 kΩ
Input frequency	≤ 30 kHz
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy	± 10 µs

ST A / input characteristics

Digital input ($B_{L/H}$)
(default: B_L)

Input resistance	10 kΩ
Input frequency	< 330 Hz
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L / B_H	± 1 % FS / ± 3 % FS
Range diagnostics	configurable minimum and maximum values
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

ST A:

IN0400...0401
IN0900...0901

Digital/ resistor inputs
(IN RESISTOR-B)

Resolution	12 bits
Input frequency	< 330 Hz
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Digital input (B_L)
(default)

Input resistance	3.2 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L	± 1% FS
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

Resistor input (R)

Measuring current	< 2.0 mA
Measuring range	0.016...30 kΩ
Accuracy	± 2% FS: 0.016...3 kΩ
Range diagnostics min./max.	0 Ω / 31 kΩ (default)

ST A:

IN0300... 0301
IN0800... 0801

Digital inputs 2-wire sensor
(IN DIGITAL-B)

Resolution	12 bits
Input frequency	< 330 Hz
Impedance	≤ 3.2 kΩ
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Digital input (B_L)

Input resistance	3.2 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L	± 1% FS
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

ST A / input characteristics

RESET-COM

Switch-on level	> 0,7 VBB_{30}
Switch-off level	< 0,3 VBB_{30}
Accuracy	± 5 % FS

Observe the notes on the configuration of the inputs/outputs.

Abbreviations

A analogue
B_H binary high side (CSO)
B_L binary low side (CSI)
$FRQ_{L/H}$ frequency/pulse inputs configurable low side (CSI) / high side (CSO)
PWM_H pulse width modulation high side (CSO)
PWM_L pulse width modulation low side (CSI)
PWM_I pulse width modulation current-controlled
R resistor input
$VBB_{0...2}$ supply output group
VBB_{30} supply controller

ST A / output characteristics

ST A:

OUT0006...0007
OUT0106...0107
OUT0206...0207

Digital / PWM outputs
4.0 A, H-bridge
(OUT PWM-40-BRIDGE-A)

Switching current	0.025...4 A
Protective circuit for inductive loads	Integrated
Accuracy current feedback	1% FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND according to programming manual detection TRUE: ≥ 3V detection FALSE: ≤ 1V

Digital output (B_H) (default)

Switching voltage	8...32 V DC
Range diagnostics min./max.	0 A / 4 A (default)

Digital output (B_L)

Functions	as H-bridge

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 4 A (default)

PWM output (PWM_L)

Output frequency	20...500 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via
Resolution	1 ‰ (at 20...250 Hz)

Current-controlled output (PWM_I)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...4 A
Setting resolution	1 mA
Control resolution	2 mA
Load resistance	≥ 3 Ω (at 12 V DC) ≥ 6 Ω (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive
Range diagnostics min./max.	0 A / 4 A (default)

ST A / output characteristics

ST A:

OUT0008
OUT0108
OUT0208

Digital / PWM outputs 4.0 A (OUT PWM-40-A)

Switching voltage	8...32 V DC
Switching current	0.025...4 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 %
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_H) (default)

Range diagnostics min./max.	0 A / 4 A (default)

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 4 A (default)

Current-controlled output (PWM_I)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...4 A
Setting resolution	1 mA
Control resolution	2 mA
Load resistance	≥ 3 Ω (at 12 V DC) ≥ 6 Ω (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 4 A (default)

ST A:

OUT0000
OUT0002
OUT0004
OUT0100
OUT0102
OUT0104
OUT0200
OUT0202
OUT0204

Digital / PWM outputs 2.5 A (OUT PWM-25-A)

Switching voltage	8...32 V DC
Switching current	0.025...2.5 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1% FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_H) (default)

Range diagnostics min./max.	0 A / 2.5 A (default)

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A / output characteristics

Current-controlled output (PWM_I)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...2.5 A
Setting resolution	1 mA (at 20...250 Hz)
Control resolution	2 mA
Load resistance	≥ 4.8 Ω / (at 12 V DC) ≥ 9.6 Ω / (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A:

OUT0001
OUT0003
OUT0005
OUT0101
OUT0103
OUT0105
OUT0201
OUT0203
OUT0205

Digital outputs 2.5 A (OUT PWM-25-B)

Switching voltage	8...32 V DC
Switching current	0.025...2.5 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	5 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_H) (default)

Range diagnostics min./max.	0 A / 2.5 A (default)

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ FS (at 20...250 Hz)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A:

OUT3000

Sensor supply (OUT SUPPLY-A)

for sensors and joysticks
0 V, / 5 V, 400 mA / 10 V, 200 mA, accuracy ± 5 %
minimum current 10 mA
short-circuit proof and overload protected

ST A:

OUT3001

Analogue outputs (OUT VOLTAGE-A)

Current rating	< 5 mA
Output voltage	0...10 V
Accuracy	± 5 % FS
Step response time 10...90	< 1.8 ms

ST A / output characteristics

Output groups $VBB_{0...2}$	
Load current per output group	≤ 12 A
Internal semiconductor switches	One switch in series of 9 semiconductor outputs each. Forced controlling by means of hardware and additional controlling by means of user program.

Switching current	0.1...12 A
Current diagnostics (excessive current)	> 12 A

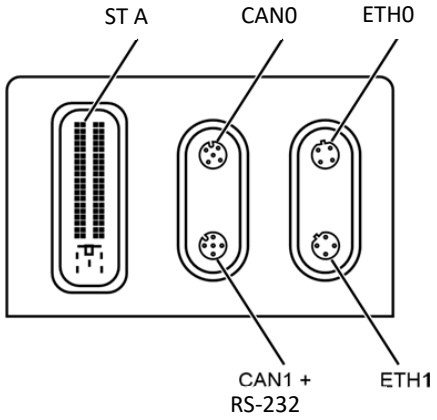
Short-circuit strength to GND	Outputs are switched off via the output driver

Abbreviations

A	analogue
B_H	binary high side (CSO)
B_L	binary low side (CSI)
PWM_H	pulse-width modulation high side (CSO)
PWM_L	pulse-width modulation low side (CSI)
PWM_I	pulse-width modulation current-controlled
$VBB_{0...2}$	supply output group
VBB_{30}	supply controller

Technical data

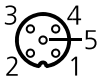
Connectors



CAN0

M12 socket, 5 poles, A-coded

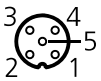
1: not used
2: not used
3: GND_COM
4: CAN0_H
5: CAN0_L



CAN1 + RS-232

M12 socket, 5 poles, A-coded

1: RS-232_TxD
2: RS-232_RxD
3: GND_COM
4: CAN1_H
5: CAN1_L



ETH0 / ETH1

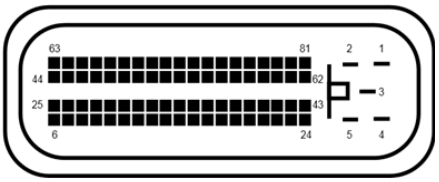
M12 socket, 4 poles, D-coded

1: TxD+
2: RxD+
3: TxD- 4: RxD-

ST A

AMP, 81-pole, A-coded

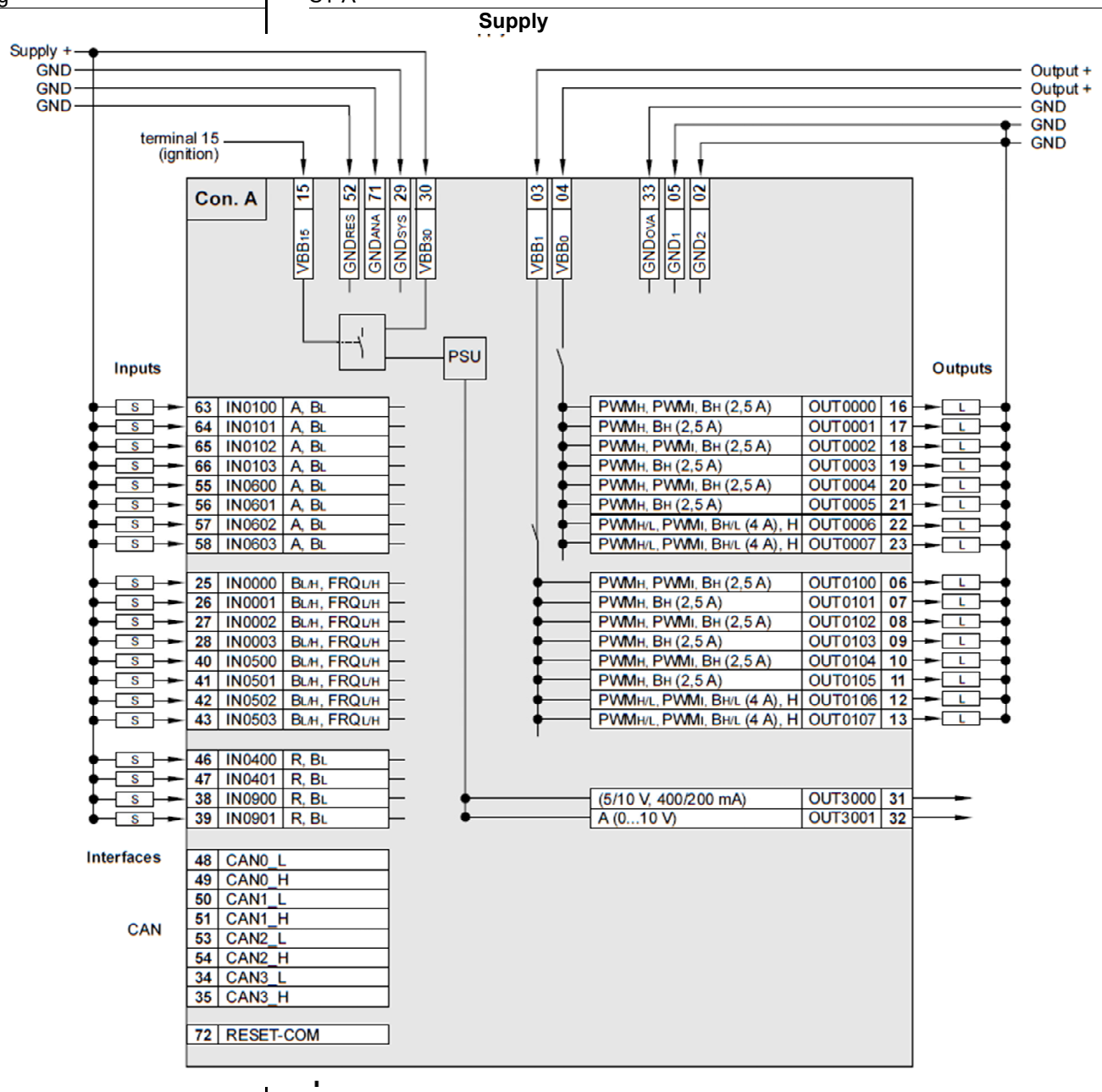
1-81: see wiring
ST A



Technical data

Wiring

ST A



Abbreviations

A	analogue
BH	binary high side (CSO)
BL	binary low side (CSI)
FRQL/H	frequency/pulse inputs configurable low side (CSI) / high side (CSO)
H	H-bridge function
PSU	power supply for the system
PWMH	pulse-width modulation high side (CSO)
PWML	pulse-width modulation low side (CSI)
PWMI	pulse-width modulation current-controlled
R	resistor input
VBB0...2	supply output group
VBB30	supply controller

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI7202424**

IEC 61508:2010 SIL 2
IEC 62061:2005 + A1:2012 + A2:2015 SIL CL 2
if used as safety controller
Suited for requirements up to:
PL d (ISO 13849-1:2015)
AgPL d(ISO 25119:2018,
DIN EN 16590:2014)

32-bit CPU TriCore processor

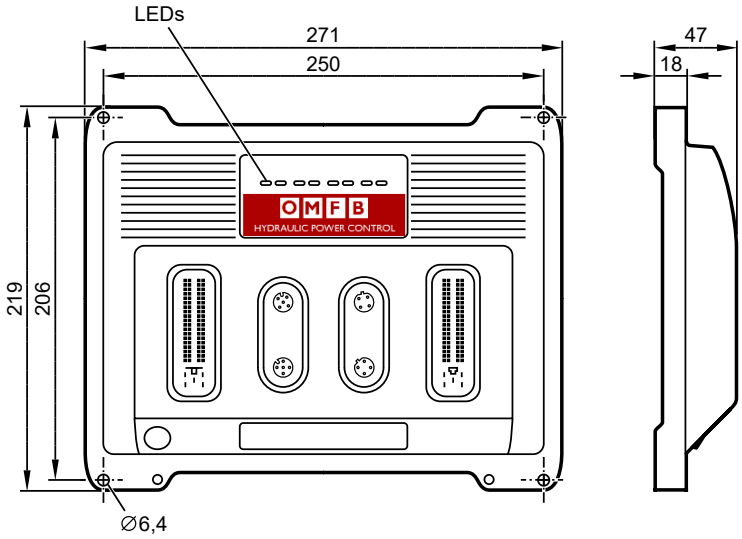
98 inputs/outputs

4 CAN interfaces

Ethernet interface

CODESYS 3.5

8...32 V DC



Technical data	Controller as a black-box system for the implementation of a central or decentralised system design
Mechanical data	
Housing	closed, screened metal housing with screw fixing
Dimensions (H x W x D)	219 x 271 x 47 mm
Installation	fixing with 4 M6 screws
Connection	2 x connector 81 poles, locked, mechanical reverse polarity and reversal protection type Tyco / AMP contacts AMP-Junior-Timer, crimp connection 0.5/0.75/2.5 mm² 2 x M12 connector 4 poles, D-coded 2 x M12 connector 5 poles, A-coded shield connection Ø 4 mm for self-tapping screw
Weight	1.6 kg
Housing/storage temperature	-40...85 °C / -40...85 °C
Max. perm. relative humidity	90 % (not condensing)
Height above sea level	max. 3000 m
Polution degree	2
Protection rating	IP 65 / IP 67 (for inserted connectors with individually sealed cores and inserted M12 connectors/sealing caps)
Electrical data	
Input/output channels, total	98 (60 inputs / 38 outputs)
Inputs	configurable, with diagnostic capability 24 x A (0...10/32 V, 0...20 mA, ratiometric) / B_L 16 x $FRQ_{L/H}$ (≤ 30 kHz) / $B_{L/H}$ 4 x R (0.016...30 kOhm) / B_L 8 x B_L (impedance ≤ 10 kOhm) 8 x B_L (impedance ≤ 3.2 kOhm)

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI7202424**

Technical data	
Outputs	configurable, with diagnostic capability 8 x $PWM_{H/L}$ / PWM_I / $B_{H/L}$ (20...2000 Hz, 4.0 A, H-bridge) 4 x PWM_H / PWM_I / B_H (20...2000 Hz, 4.0 A) 12 x PWM_H / PWM_I / B_H (20...2000 Hz, 2.5 A) 12 x PWM_H / B_H 2.5 A 2 x A (0...10 V)
Sensor supply	1 x 0/5/10 V, max. 2 W configurable
	For the number of inputs/outputs and configuration options also see the wiring diagrams
Operating voltage Overvoltage	8...32 V DC 36 V for t ≤ 10 s
Reverse polarity protection	yes, in case of supply via the on-board system (battery)
Power consumption VBB_{30}	8 W
CAN interfaces 0...3 Baud rate Communication profile	CAN interface 2.0 A/B, ISO 11898 20 kbit/s...1 Mbit/s (default 250 kbit/s) CANopen, CiA DS 301 V4.2, CiA DS 401 V1.4 / SAE J 1939 / free protocol CANopen Safety for safe data transmission
Serial interface Baud rate Topology	RS-232 9.6...115.2 kbit/s (default 115.2 kbit/s) point-to-point (max. 2 participants); master-slave connection
Ethernet interface Transmission rate Protocols	1 interface with integrated switch and 2 ports 10/100 Mbit/s TCP/IP, UDP/IP, Modbus UDP
Processor	32-bit TriCore CPU Infineon AURIX™
Device monitoring	overvoltage and undervoltage monitoring watchdog function (extended safety monitoring to IEC 62061 and ISO13849) checksum test for program and system excess temperature monitoring
Process monitoring concept	second switch-off way per output group via semiconductor switch
Physical memory	flash: 9 Mbytes RAM: 2.7 Mbytes non-volatile memory: 10 kBytes
Memory allocation	Memory can be allocated for safe and non-safe applications see programming manual
Software/programming	
Programming system	CODESYS version 3.5 with SIL 2 extension (IEC 61131-3)
Light indicators	
Status LED	2 x two-colour LED (R/G) for SYS0 and SYS1
Ethernet LED	2 x LED (G) for ETH0 and ETH1
Application LED	4 x three-colour LED (R/G/B) for APP0, APP1, APP2 and APP3, programmable

Technical data

Operating states system

LED SYS0		LED SYS1		System state
Colour	State	Colour	State	
–	off	–	off	no operating voltage
green	5 Hz	–	off	no operating system loaded
red	on	–	off	hardware error (fatal error+)
red	on	red	on	system error (fatal error)
green/ yellow	2 Hz	green/ yellow	2 Hz	update

Operating states PLC/application

LED	Colour	Status	Description	
SYS0	green	on	Standard PLC	no application
		2 Hz		run
	red	10Hz		error application (serious error)
	yellow	2 Hz		debug run
		on		debug stop
SYS1	green	on	Safety PLC	no application
		2 Hz		run
	red	10Hz		error application (serious error)
	yellow	2 Hz		debug run
		on		debug stop
ETH0	green	flashing	data transmission Ethernet	
		on	Ethernet connection ok, no data transfer	
ETH1	green	flashing	data transmission Ethernet	
		on	Ethernet connection ok, no data transfer	
APP0	red	on	status display of the application, freely	
...	green	on	status display of the application, freely	
APP3	blue	on	status display of the application, freely	

Safety-related characteristics

Safety Integrity Level Claim Limit	SIL CL	2

Component	PFH_D [1/h]
Input, external, single channel	$< 4.0 \times 10^{-9}$
Input, external, dual channel	$< 5.0 \times 10^{-10}$
Logic	$< 1.0 \times 10^{-7}$
Output, external, single channel	$< 2.0 \times 10^{-8}$
Output, external, dual channel	$< 1.0 \times 10^{-9}$

Lifetime: 20 years

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI7202424**

Technical data		
Test standards and regulations		
CE mark	EN IEC 62061	Safety of machinery - Functional safety of electrical, electronic and programmable safety-related control systems
	EN 61000-6-2	Electromagnetic compatibility (EMC)
	EN 61000-6-4	Electromagnetic compatibility (EMC) Emission
	EN 61010	Safety requirements for electrical equipment for measurement, control and laboratory use
E1 mark	UN/ECE-R10	Noise emission Noise immunity with 100 V/m
Electrical tests	ISO 7637-2	Pulse 1, severity level: IV; function state C Pulse 2a, severity level: IV; function state A Pulse 2b, severity level: IV; function state C Pulse 3a, severity level: IV; function state A Pulse 3b, severity level: IV; function state A Pulse 4, severity level: IV; function state A Pulse 5, severity level: III; function state A (data valid for the 24 V system) Pulse 4, severity level: III; function state A (data valid for the 12 V system)
Climatic tests	EN 60068-2-30	Damp heat, cyclic Upper temperature 55 °C, number of cycles: 6
	EN 60068-2-78	Damp heat, steady state Test temperature 40°C / 93% RH, test duration: 21 days
	EN 60068-2-52	Salt spray test Severity level 3 (vehicle)
Mechanical tests	ISO 16750-3	Test VII; vibration, random Mounting location: vehicle body
	EN 60068-2-6	Vibration, sinusoidal 10...500 Hz; 0.72 mm/10 g; 10 cycles/axis
	ISO 16750-3	Bump 30 g/6 ms; 24,000 shocks
Safety-related tests	IEC 61508	parts 1-7 Functional safety of electrical/electronic/programmable electronic safety-related systems
	EN 62061	Safety of machinery - Functional safety of electrical, electronic and programmable safety- related control systems
Chemical resistance	ISO 16750-5	AA, BA, BD, CC, DB, DC, DD, Only one chemical permitted at a time

ST A and ST B / input characteristics

ST A: **ST B:**

IN0100...0103 **IN1100...1103**
IN0200...0203 **IN1600...1603**
IN0600...0603
IN0700...0703

Multifunction inputs analogue/ digital
(IN MULTIFUNCTION-A)

Resolution	12 bits
Input frequency	< 330 Hz
Measuring ranges	0...10 V, 0...32 V, 0...20 mA, ratiometric, binary low side
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Current input 0 … 20 mA (A)

Input resistance	298 Ω
Range diagnostics min./max.	0 mA / 20 mA (default)
Accuracy	± 1.5 % FS

Voltage input 0...10 V (A)

Input resistance	67.6 kΩ
Range diagnostics min./max.	0 V / 10 V (default)
Accuracy	± 1 % FS

Voltage input 0...32 V (A)

Input resistance	51.0 kΩ
Range diagnostics min./max.	0 V / 32 V (default)
Accuracy	± 1 % FS

Voltage input ratiometric (A)

Input resistance	51.0 kΩ
Range diagnostics min./max.	0 ‰ / 1000 ‰ (default)
Accuracy	± 1 % FS

Digital input (B_L) (default)

Input resistance	9.5 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)
Accuracy	± 1 % FS

ST A: **ST B:**

IN0000...0003 **IN1000...1003**
IN0500...0503 **IN1500...1503**

Digital inputs, frequency measurement
(IN FREQUENCY-B)

Resolution	12 bits

Frequency input ($FRQ_{L/H}$)

Input resistance	10 kΩ
Input frequency	≤ 30 kHz
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy	± 10 µs

ST A and ST B / input characteristics

Digital input ($B_{L/H}$)
(default: B_L)

Input resistance	10 kΩ
Input frequency	< 330 Hz
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L / B_H	± 1 % FS / ± 3 % FS
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

ST A:

IN0400...0401
IN0900...0901

Digital / resistor inputs
(IN RESISTOR-B)

Resolution	12 bits
Input frequency	< 330 Hz
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Digital input (B_L)
(default)

Input resistance	3.2 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

Resistor input (R)

Measuring current	< 2.0 mA
Measuring range	0.016…30 kΩ
Accuracy	± 2 % FS: 0.016…3 kΩ ± 5 % FS: 3…15 kΩ ± 10 % FS: 15…30 kΩ
Range diagnostics min./max.	0 Ω / 31 kΩ (default)

ST B:

IN1200... 1203
IN1700... 1703

Digital inputs
(IN DIGITAL-A)

Resolution	12 bits
Input frequency	< 330 Hz
Impedance	≤ 10 kΩ
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Digital input (B_L)

Input resistance	10 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

ST A and ST B / input characteristics

ST A: **ST B:**

IN0300... 0301 **IN1300... 1303**
IN0800... 0801

Digital inputs 2-wire sensor (IN DIGITAL-B)

Resolution	12 bits
Input frequency	< 330 Hz
Impedance	≤ 3.2 kΩ
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Digital input (B_L)

Input resistance	3.2 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

RESET-COM

Switch-on level	> 0,7 VBB_{30}
Switch-off level	< 0,3 VBB_{30}
Accuracy	± 5 % FS

Observe the notes on the configuration of the inputs/outputs!

Abbreviations

A analogue
B_H binary high side (CSO)
B_L binary low side (CSI)
$FRQ_{L/H}$ frequency/pulse inputs configurable low side (CSI) / high side (CSO)
PWM_H pulse width modulation high side (CSO)
PWM_L pulse width modulation low side (CSI)
PWM_I pulse width modulation current-controlled
R resistor input
$VBB_{0...3}$ supply output group
VBB_{30} supply controller

ST A and ST B / output characteristics

ST A: **ST B:**

OUT0006...0007 **OUT0306...0307**
OUT0106...0107
OUT0206...0207

Digital / PWM outputs
4.0 A, H-bridge
(OUT PWM-40-BRIDGE-A)

Switching current	0.025...4 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND according to the programming manual detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_H) (default)

Switching voltage	8...32 V DC
Range diagnostics min./max.	0 A / 4 A (default)

Digital output (B_L)

Functions	as H-bridge

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 4 A (default)

PWM output (PWM_L)

Output frequency	20...500 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)

Current-controlled output (PWM_I)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...4 A
Setting resolution	1 mA
Control resolution	2 mA
Load resistance	≥ 3 Ω (at 12 V DC) ≥ 6 Ω (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 4 A (default)

ST A and ST B / output characteristics

ST A: **ST B:**

OUT0008 **OUT0308**
OUT0108
OUT0208

Digital / PWM outputs 4.0 A (OUT PWM-40-A)

Switching voltage	8...32 V DC
Switching current	0.025...4 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_H) (default)

Range diagnostics min./max.	0 A / 4 A (default)

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 4 A (default)

Current-controlled output (PWM_I)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...4 A
Setting resolution	1 mA
Control resolution	2 mA
Load resistance	≥ 3 Ω (at 12 V DC) ≥ 6 Ω (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 4 A (default)

ST A: **ST B:**

OUT0000 **OUT0300**
OUT0002 **OUT0302**
OUT0004 **OUT0304**
OUT0100
OUT0102
OUT0104
OUT0200
OUT0202
OUT0204

Digital / PWM outputs 2.5 A (OUT PWM-25-A)

Switching voltage	8...32 V DC
Switching current	0.025...2.5 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_H) (default)

Range diagnostics min./max.	0 A / 2.5 A (default)

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A and ST B / output characteristics

Current-controlled output (PWM_I)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...2.5 A
Setting resolution	1 mA (at 20...250 Hz)
Control resolution	2 mA
Load resistance	≥ 4.8 Ω / (at 12 V DC) ≥ 9.6 Ω / (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A:

OUT0001
OUT0003
OUT0005
OUT0101
OUT0103
OUT0105
OUT0201
OUT0203
OUT0205

ST B:

OUT0301
OUT0303
OUT0305

Digital outputs 2.5 A
(OUT PWM-25-B)

Switching voltage	8...32 V DC
Switching current	0.025...2.5 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	5 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_H)
(default)

Range diagnostics min./max.	0 A / 2.5 A (default)

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ FS (at 20...250 Hz)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A:

OUT3000

Sensor supply
(OUT SUPPLY-A)

For sensors and joysticks
0 V / 5 V, 400 mA / 10 V, 200 mA, accuracy ± 5 %
Minimum current 10 mA
Short-circuit proof and overload protected

ST A and ST B / output characteristics

ST A: **ST B:**

OUT3001 **OUT3002**

Analogue outputs (OUT VOLTAGE-A)

Current rating	< 5 mA
Output voltage	0...10 V
Accuracy	± 5 % FS
Step response time 10...90 %	< 1.8 ms

Output groups $VBB_{0...3}$

Load current per output group	≤ 12 A
Internal semiconductor switches	One switch in series of 9 semiconductor outputs each Forced controlling by means of hardware and additional controlling by means of user program

Switching current	0.1...12 A
Current diagnostics excessive current)	> 12 A

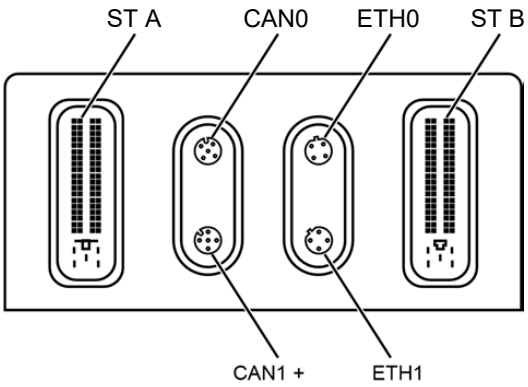
Short-circuit strength to GND	Outputs are switched off via the output driver

Abbreviations

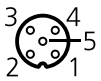
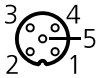
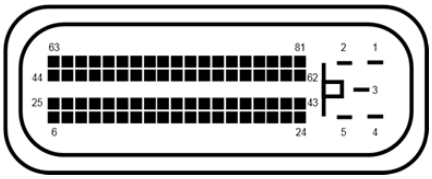
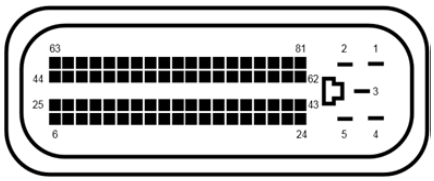
A analogue
B_H binary high side (CSO)
B_L binary low side (CSI)
PWM_H pulse-width modulation high side (CSO)
PWM_L pulse-width modulation low side (CSI)
PWM_I pulse-width modulation current-controlled
$VBB_{0...3}$ supply output group
VBB_{30} supply controller

Technical data

Connectors



RS-232

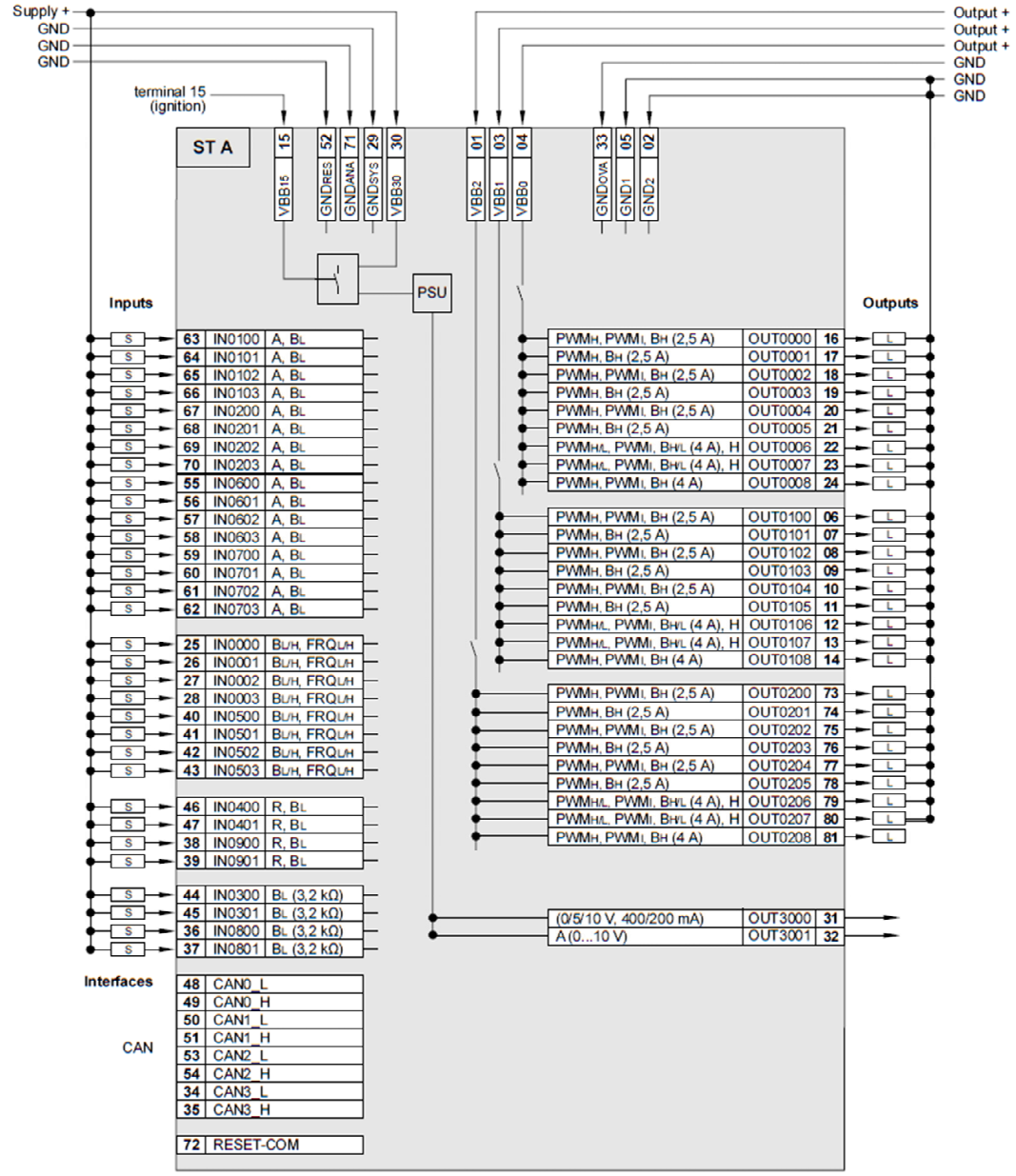
CAN0	M12 socket, 5 poles, A-coded 1: not used 2: not used 3: GND_COM 4: CAN0_H 5: CAN0_L 
CAN1 + RS-232	M12 socket, 5 poles, A-coded 1: RS-232_TxD 2: RS-232_RxD 3: GND_COM 4: CAN1_H 5: CAN1_L 
ETH0 / ETH1	M12 socket, 4 poles, D-coded 1: TxD+ 2: RxD+ 3: TxD- 4: RxD- 
ST A	AMP, 81 poles, A-coded 1-81: see wiring ST A 
ST B	AMP, 81 poles, B-coded 1-81: see wiring ST B 

Technical data

Wiring

ST A

Supply



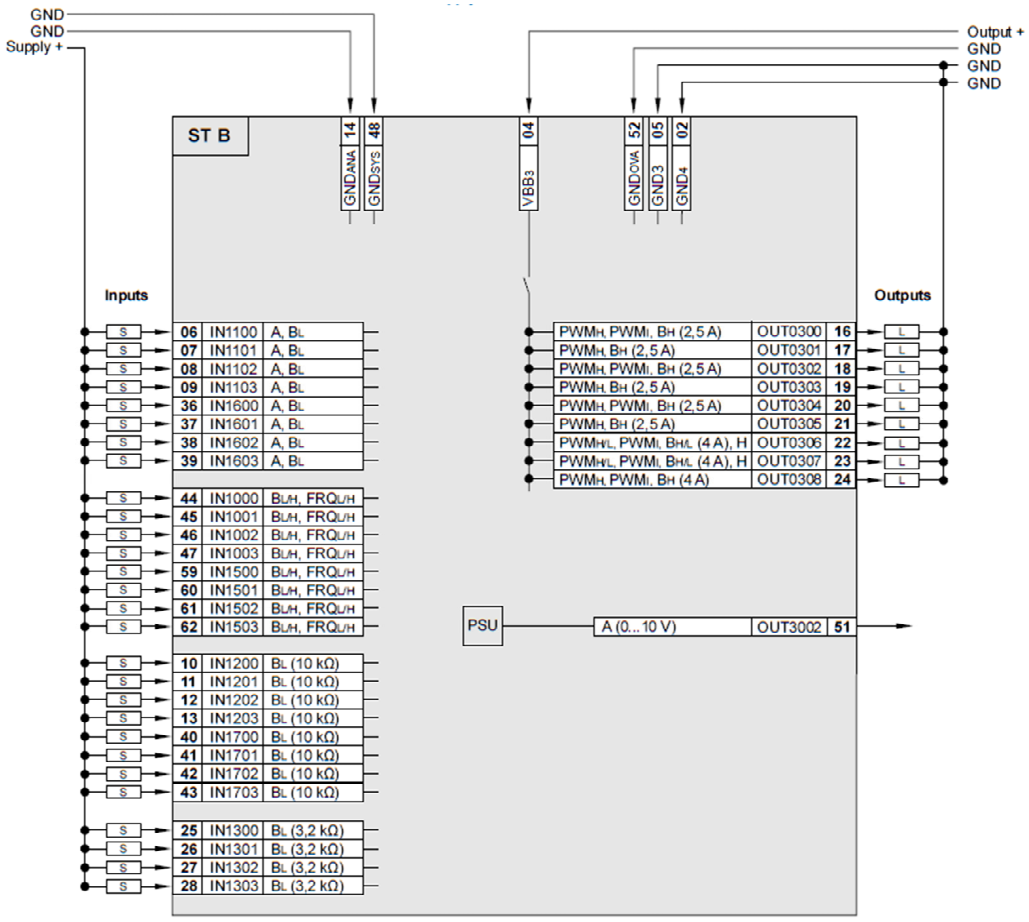
Abbreviations

A	analogue
BH	binary high side (CSO)
BL	binary low side (CSI)
FRQL/H	frequency/pulse inputs configurable low side (CSI) / high side (CSO)
H	H-bridge function
PSU	power supply for the system
PWMH	pulse-width modulation high side (CSO)
PWML	pulse-width modulation low side (CSI)
PWMI	pulse-width modulation current-controlled
R	resistor input
VBB0...2	supply output group
VBB30	supply controller

Technical data

Wiring

ST B



Abbreviations

A	analogue
BH	binary high side (CSO)
BL	binary low side (CSI)
FRQL/H	frequency/pulse inputs configurable low side (CSI) / high side (CSO)
H	H-bridge function
PSU	power supply for the system
PWMH	pulse-width modulation high side (CSO)
PWML	pulse-width modulation low side (CSI)
PWMI	pulse-width modulation current-controlled
R	resistor input
VBB0...2	supply output group
VBB30	supply controller

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI7213624**

IEC 61508:2010 SIL 2
IEC 62061:2005 + A1:2012 + A2:2015 SIL CL 2
if used as safety controller
Suited for requirements up to:
PL d (ISO 13849-1:2015)
AgPL d(ISO 25119:2018,
DIN EN 16590:2014)

32-bit CPU TriCore processor

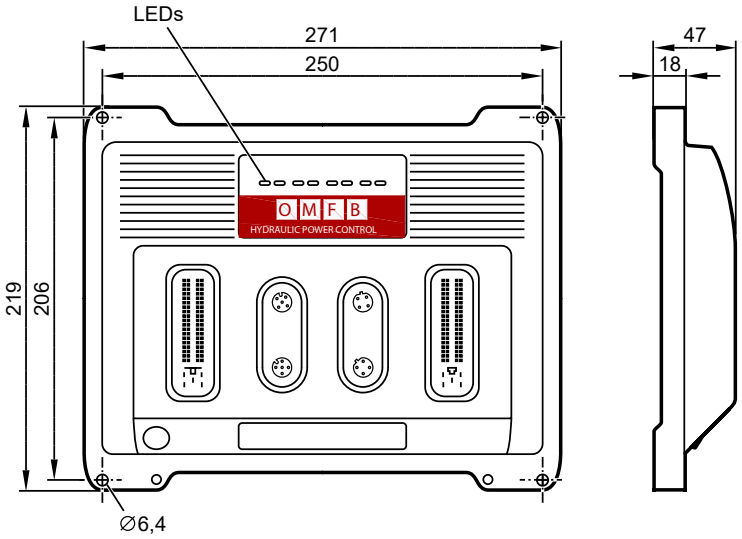
124 inputs/outputs

4 CAN interfaces

Ethernet interface

CODESYS 3.5

8...32 V DC



CE

E1

Technical data	Controller as black box system for the implementation of a central or decentralised system design
Mechanical data	
Housing	closed, screened metal housing with screw fixing
Dimensions (H x W x D)	219 x 271 x 47 mm
Installation	fixing with 4 M6 screws
Connection	2 x connector 81 poles, locked, mechanical reverse polarity and reversal protection type Tyco / AMP contacts AMP-Junior-Timer, crimp connection 0.5/0.75/2.5 mm² 2 x M12 connector 4 poles, D-coded 2 x M12 connector 5 poles, A-coded shield connection Ø 4 mm for self-tapping screw
Weight	1.6 kg
Housing/storage temperature	– 40...85 °C / – 40...85 °C
Max. perm. relative humidity	90 % (not condensing)
Height above sea level	max. 3000 m
Degree of soiling	2
Protection rating	IP 65 / IP 67 (for inserted connectors with individually sealed cores and inserted M12 connectors/sealing caps)
Electrical data	
Input/output channels, total	124 (68 inputs / 56 outputs)
Inputs	configurable, with diagnostic capability 24 x A (0...10/32 V, 0...20 mA, ratiometric) / BL 16 x $FRQ_{L/H}$ (≤ 30 kHz) / BL/H 4 x R (0.016...30 kOhm) / BL 16 x B_L (impedance ≤ 10 kOhm) 8 x B_L (impedance ≤ 3.2 kOhm

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI7213624**

Technical data	
Outputs	configurable, with diagnostic capability 12 x $PWM_{H/L}$ / PWM_I / $B_{H/L}$ (20...2000 Hz, 4.0 A, H-bridge) 6 x PWM_H / PWM_I / B_H (20...2000 Hz, 4.0 A) 18 x PWM_H / PWM_I / B_H (20...2000 Hz, 2.5 A) 18 x PWM_H / B_H 2.5 A 2 x A (0...10 V)
Sensor supply	1 x 0/5/10 V, max. 2 W configurable
	For the number of inputs/outputs and configuration options also see the wiring diagrams
Operating voltage Overvoltage	8...32 V DC 36 V for t ≤ 10 s
Reverse polarity protection	yes, in case of supply via the on-board system (battery)
Power consumption VBB_{30}	8 W
CAN interfaces 0...3 Baud rate Communication profile	CAN interface 2.0 A/B, ISO 11898 20 kbit/s...1 Mbit/s (default 250 kbit/s) CANopen, CiA DS 301 V4.2, CiA DS 401 V1.4 / SAE J 1939 / free protocol CANopen Safety for safe data transmission
Serial interface Baud rate Topology	RS-232 9.6...115.2 kbit/s (default 115.2 kbit/s) point-to-point (max. 2 participants); master-slave connection
Ethernet interface Transmission rate Protocols	1 interface with integrated switch and 2 ports 10/100 Mbit/s TCP/IP, UDP/IP, Modbus UDP
Processor	32-bit TriCore CPU Infineon AURIX™
Device monitoring	overvoltage and undervoltage monitoring watchdog function (extended safety monitoring to IEC 62061 and ISO13849) checksum test for program and system excess temperature monitoring
Process monitoring concept	second switch-off way per output group via semiconductor switch
Physical memory	flash: 9 Mbytes RAM: 2.7 Mbytes non-volatile memory: 10 kBytes
Memory allocation	Memory can be allocated for safe and non-safe applications see programming manual
Software/programming	
Programming system	CODESYS version 3.5 with SIL 2 extension (IEC 61131-3)
Indicators	
Status LED	2 x two-colour LED (R/G) for SYS0 and SYS1
Ethernet LED	2 x LED (G) for ETH0 and ETH1
Application LED	4 x three-colour LED (R/G/B) for APP0, APP1, APP2 and APP3, programmable

Technical data

Operating states system

LED SYS0		LED SYS1		System state
Colour	State	Colour	State	
–	off	–	off	no operating voltage
green	5 Hz	–	off	no operating system loaded
red	on	–	off	hardware error (fatal error+)
red	on	red	on	system error (fatal error)
green/ yellow	2 Hz	green/ yellow	2 Hz	update

Operating states PLC/application

LED	Colour	Status	Description	
SYS0	green	on	Standard PLC	no application
		2 Hz		run
	red	10Hz		error application (serious error)
	yellow	2 Hz		debug run
		on		debug stop
SYS1	green	on	Safety PLC	no application
		2 Hz		run
	red	10Hz		error application (serious error)
	yellow	2 Hz		debug run
		on		debug stop
ETH0	green	flashing	data transmission Ethernet	
		on	Ethernet connection ok, no data transfer	
ETH1	green	flashing	data transmission Ethernet	
		on	Ethernet connection ok, no data transfer	
APP0	red	on	status display of the application, freely	
...	green	on	status display of the application, freely	
APP3	blue	on	status display of the application, freely	

Safety-related characteristics

Safety Integrity Level Claim Limit	SIL CL	2

Component	PFH_D [1/h]
Input, external, single channel	$< 4.0 \times 10^{-9}$
Input, external, dual channel	$< 5.0 \times 10^{-10}$
Logic	$< 1.0 \times 10^{-7}$
Output, external, single channel	$< 2.0 \times 10^{-8}$
Output, external, dual channel	$< 1.0 \times 10^{-9}$

Lifetime: 20 years

Technical data		
Test standards and regulations		
CE mark	EN IEC 62061	Safety of machinery - Functional safety of electrical, electronic and programmable safety-related control systems
	EN 61000-6-2	Electromagnetic compatibility (EMC)
	EN 61000-6-4	Electromagnetic compatibility (EMC) Emission
	EN 61010	Safety requirements for electrical equipment for measurement, control and laboratory use
E1 mark	UN/ECE-R10	Noise emission Noise immunity with 100 V/m
Electrical tests	ISO 7637-2	Pulse 1, severity level: IV; function state C Pulse 2a, severity level: IV; function state A Pulse 2b, severity level: IV; function state C Pulse 3a, severity level: IV; function state A Pulse 3b, severity level: IV; function state A Pulse 4, severity level: IV; function state A Pulse 5, severity level: III; function state A (data valid for the 24 V system) Pulse 4, severity level: III; function state A (data valid for the 12 V system)
Climatic tests	EN 60068-2-30	Damp heat, cyclic Upper temperature 55 °C, number of cycles: 6
	EN 60068-2-78	Damp heat, steady state Test temperature 40°C / 93% RH, test duration: 21 days
	EN 60068-2-52	Salt spray test Severity level 3 (vehicle)
Mechanical tests	ISO 16750-3	Test VII; vibration, random Mounting location: vehicle body
	EN 60068-2-6	Vibration, sinusoidal 10...500 Hz; 0.72 mm/10 g; 10 cycles/axis
	ISO 16750-3	Bump 30 g/6 ms; 24,000 shocks
Safety-related tests	IEC 61508	parts 1-7 Functional safety of electrical/electronic/programmable electronic safety-related systems
	EN 62061	Safety of machinery - Functional safety of electrical, electronic and programmable safety- related control systems
Chemical resistance	ISO 16750-5	AA, BA, BD, CC, DB, DC, DD, Only one chemical permitted at a time

ST A and ST B / input characteristics

ST A: **ST B:**

IN0100...0103 **IN1100...1103**
IN0200...0203 **IN1600...1603**
IN0600...0603
IN0700...0703

Multifunction inputs analogue / digital (IN MULTIFUNCTION-A)

Resolution	12 bits
Input frequency	< 330 Hz
Measuring ranges	0...10 V, 0...32 V, 0...20 mA, ratiometric, binary low side
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Current input 0 … 20 mA (A)

Input resistance	298 Ω
Range diagnostics min./max.	0 mA / 20 mA (default)
Accuracy	± 1.5 % FS

Voltage input 0...10 V (A)

Input resistance	67.6 kΩ
Range diagnostics min./max.	0 V / 10 V (default)
Accuracy	± 1 % FS

Voltage input 0...32 V (A)

Input resistance	51.0 kΩ
Range diagnostics min./max.	0 V / 32 V (default)
Accuracy	± 1 % FS

Voltage input ratiometric (A)

Input resistance	51.0 kΩ
Range diagnostics min./max.	0 ‰ / 1000 ‰ (default)
Accuracy	± 1 % FS

Digital input (B_L) (default)

Input resistance	9.5 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)
Accuracy	± 1 % FS

ST A: **ST B:**

IN0000...0003 **IN1000...1003**
IN0500...0503 **IN1500...1503**

Digital inputs, frequency measurement (IN FREQUENCY-B)

Resolution	12 bits

Frequency input ($FRQ_{L/H}$)

Input resistance	10 kΩ
Input frequency	≤ 30 kHz
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy	± 10 µs

ST A and ST B / input characteristics

Digital input ($B_{L/H}$)
(default: B_L)

Input resistance	10 kΩ
Input frequency	< 330 Hz
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L / B_H	± 1 % FS / ± 3 % FS
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

ST A:

IN0400...0401
IN0900...0901

Digital / resistor inputs
(IN RESISTOR-B)

Resolution	12 bits
Input frequency	< 330 Hz
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Digital input (B_L)
(default)

Input resistance	3.2 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

Resistor input (R)

Measuring current	< 2.0 mA
Measuring range	0.016…30 kΩ
Accuracy	± 2 % FS: 0.016…3 kΩ ± 5 % FS: 3…15 kΩ ± 10 % FS: 15…30 kΩ
Range diagnostics min./max.	0 Ω / 31 kΩ (default)

ST B:

IN1200... 1203
IN1700... 1703

Digital inputs
(IN DIGITAL-A)

Resolution	12 bits
Input frequency	< 330 Hz
Impedance	≤ 10 kΩ
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Digital input (B_L)

Input resistance	10 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

ST A and ST B / input characteristics

ST A: **ST B:**

IN0300... 0301 **IN1300... 1303**
IN0800... 0801

Digital inputs 2-wire sensor (IN DIGITAL-B)

Resolution	12 bits
Input frequency	< 330 Hz
Impedance	≤ 3.2 kΩ
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Digital input (B_L)

Input resistance	3.2 kΩ
Switch-on level	> 0.7 VBB_{30}
Switch-off level	< 0.3 VBB_{30}
Accuracy B_L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 VBB_{30} (default)

RESET-COM

Switch-on level	> 0,7 VBB_{30}
Switch-off level	< 0,3 VBB_{30}
Accuracy	± 5 % FS

Observe the notes on the configuration of the inputs/outputs!

Abbreviations

A analogue
B_H binary high side (CSO)
B_L binary low side (CSI)
$FRQ_{L/H}$ frequency/pulse inputs configurable low side (CSI) / high side (CSO)
PWM_H pulse width modulation high side (CSO)
PWM_L pulse width modulation low side (CSI)
PWM_I pulse width modulation current-controlled
R resistor input
$VBB_{0...3}$ supply output group
VBB_{30} supply controller

ST A and ST B / output characteristics

ST A: **ST B:**

OUT0006...0007 **OUT0306...0307**
OUT0106...0107 **OUT0406...0407**
OUT0206...0207 **OUT0506...0507**

Digital / PWM outputs
4.0 A, H-bridge
(OUT PWM-40-BRIDGE-A)

Switching current	0.025...4 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND according to the programming manual detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_H) (default)

Switching voltage	8...32 V DC
Range diagnostics min./max.	0 A / 4 A (default)

Digital output (B_L)

Functions	as H-bridge

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 4 A (default)

PWM output (PWM_L)

Output frequency	20...500 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)

Current-controlled output (PWM_I)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...4 A
Setting resolution	1 mA
Control resolution	2 mA
Load resistance	≥ 3 Ω (at 12 V DC) ≥ 6 Ω (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 4 A (default)

ST A and ST B / output characteristics

ST A: **ST B:**

OUT0008 **OUT0308**
OUT0108 **OUT0408**
OUT0208 **OUT0508**

Digital / PWM outputs 4.0 A (OUT PWM-40-A)

Switching voltage	8...32 V DC
Switching current	0.025...4 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_H) (default)

Range diagnostics min./max.	0 A / 4 A (default)

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 4 A (default)

Current-controlled output (PWM_I)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...4 A
Setting resolution	1 mA
Control resolution	2 mA
Load resistance	≥ 3 Ω (at 12 V DC) ≥ 6 Ω (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 4 A (default)

ST A: **ST B:**

OUT0000 **OUT0300**
OUT0002 **OUT0302**
OUT0004 **OUT0304**
OUT0100 **OUT0400**
OUT0102 **OUT0402**
OUT0104 **OUT0404**
OUT0200 **OUT0500**
OUT0202 **OUT0502**
OUT0204 **OUT0504**

Digital / PWM outputs 2.5 A (OUT PWM-25-A)

Switching voltage	8...32 V DC
Switching current	0.025...2.5 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_H) (default)

Range diagnostics min./max.	0 A / 2.5 A (default)

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A and ST B / output characteristics

Current-controlled output (PWM_I)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...2.5 A
Setting resolution	1 mA (at 20...250 Hz)
Control resolution	2 mA
Load resistance	≥ 4.8 Ω / (at 12 V DC) ≥ 9.6 Ω / (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A:

OUT0001
OUT0003
OUT0005
OUT0101
OUT0103
OUT0105
OUT0201
OUT0203
OUT0205

ST B:

OUT0301
OUT0303
OUT0305
OUT0401
OUT0403
OUT0405
OUT0501
OUT0503
OUT0505

Digital outputs 2.5 A (OUT PWM-25-B)

Switching voltage	8...32 V DC
Switching current	0.025...2.5 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	5 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_H) (default)

Range diagnostics min./max.	0 A / 2.5 A (default)

PWM output (PWM_H)

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ FS (at 20...250 Hz)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A and ST B / output characteristics

ST A:

OUT3000

Sensor supply (OUT SUPPLY-A)

For sensors and joysticks
0 V / 5 V, 400 mA / 10 V, 200 mA, accuracy ± 5 %
Minimum current 10 mA
Short-circuit proof and overload protected

ST A: **ST B:**

OUT3001 **OUT3002**

Analogue outputs (OUT VOLTAGE-A)

Current rating	< 5 mA
Output voltage	0...10 V
Accuracy	± 5 % FS
Step response time 10...90 %	< 1.8 ms

Output groups $VBB_{0...3}$

Load current per output group: ≤ 12 A

Internal semiconductor switches: One switch in series of 9 semiconductor outputs each
Forced controlling by means of hardware and additional controlling by means of user program

Switching current	0.1...12 A
Current diagnostics excessive current)	> 12 A

Short-circuit strength to GND: Outputs are switched off via the output driver

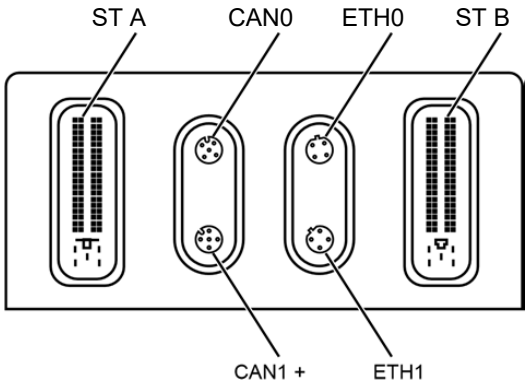
Abbreviations

A	analogue
B_H	binary high side (CSO)
B_L	binary low side (CSI)
PWM_H	pulse-width modulation high side (CSO)
PWM_L	pulse-width modulation low side (CSI)
PWM_I	pulse-width modulation current-controlled
$VBB_{0...3}$	supply output group
VBB_{30}	supply controller

I/O controller for PDV Proportional valve - PHSI series
Code number: **PHSI7213624**

Technical data

Connectors



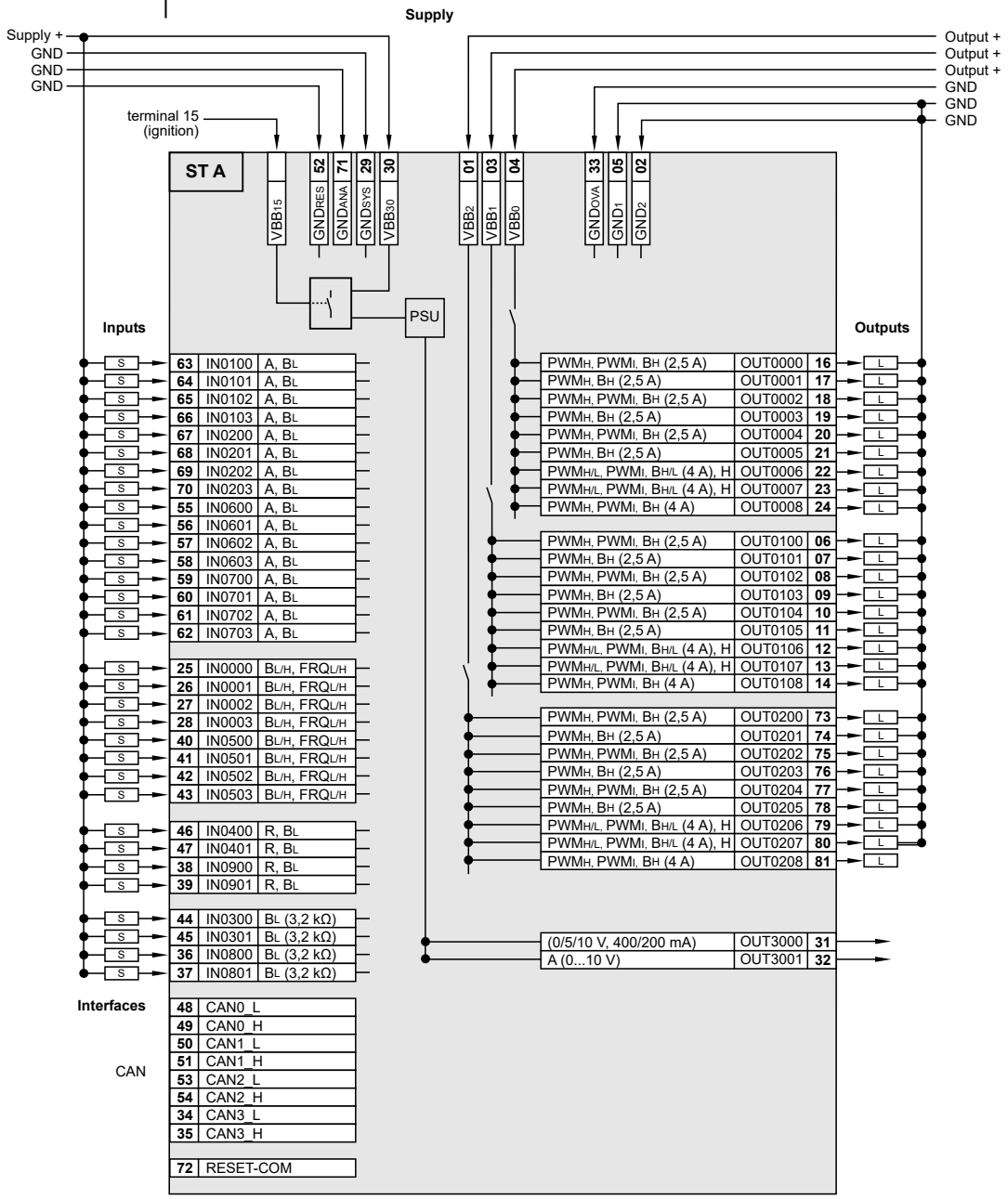
RS-232

CAN0	M12 socket, 5 poles, A-coded 1: not used 2: not used 3: GND_COM 4: CAN0_H 5: CAN0_L
CAN1 + RS-232	M12 socket, 5 poles, A-coded 1: RS-232_TxD 2: RS-232_RxD 3: GND_COM 4: CAN1_H 5: CAN1_L
ETH0 / ETH1	M12 socket, 4 poles, D-coded 1: TxD+ 2: RxD+ 3: TxD- 4: RxD-
ST A	AMP, 81 poles, A-coded 1-81: see wiring ST A
ST B	AMP, 81 poles, B-coded 1-81: see wiring ST B

Technical data

Wiring

ST A



Abbreviations

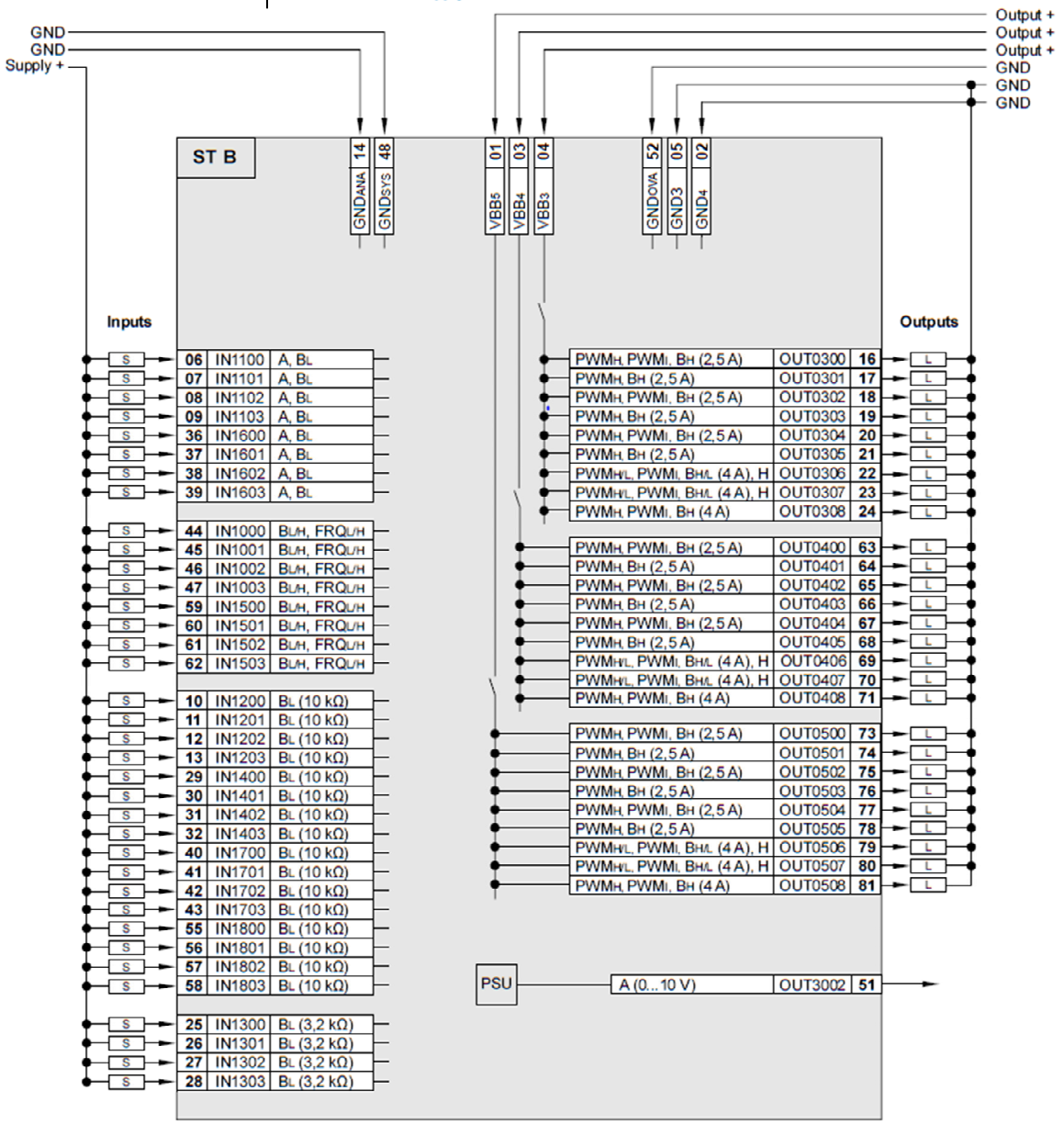
A	analogue
BH	binary high side (CSO)
BL	binary low side (CSI)
FRQL/H	frequency/pulse inputs configurable low side (CSI) / high side (CSO)
H	H-bridge function
PSU	power supply for the system
PWMH	pulse-width modulation high side (CSO)
PWML	pulse-width modulation low side (CSI)
PWMI	pulse-width modulation current-controlled
R	resistor input
VBB0...2	supply output group
VBB30	supply controller

Technical data

Wiring

ST B

Supply



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PWML	pulse-width modulation low side (CSI)
PWMI	pulse-width modulation current-controlled
R	resistor input
VBB0...2	supply output group
VBB30	supply controller