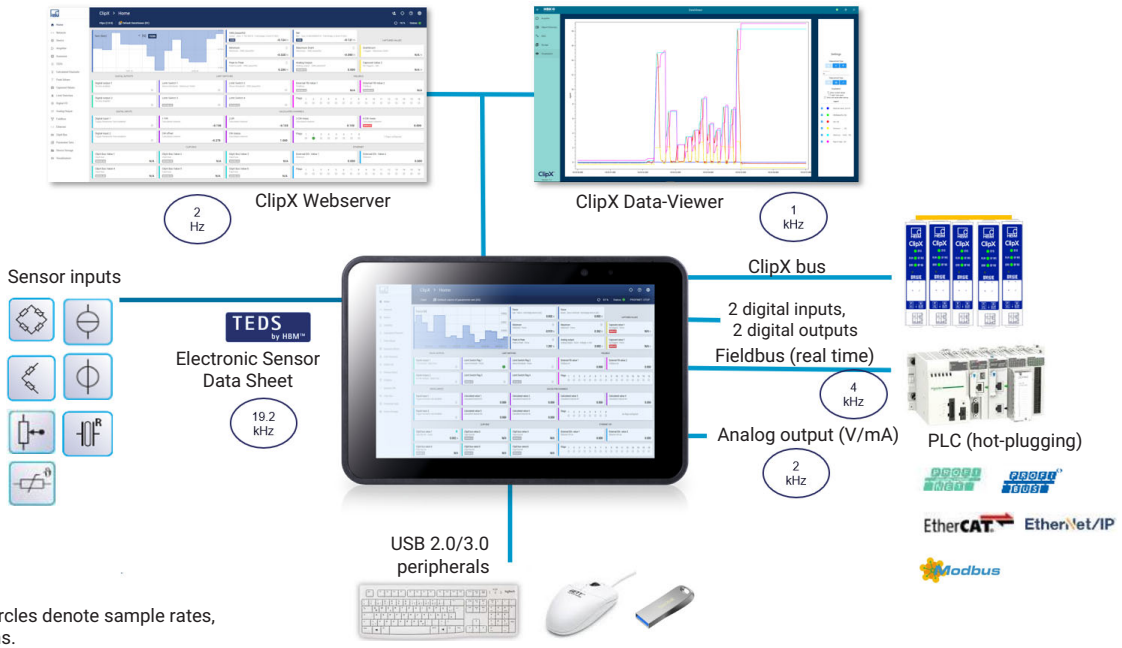
DATA SHEET

ScoutX
Tablet amplifier with display and data logger

CHARACTERISTIC FEATURES

- 10" multi-touch tablet PC (Intel Atom) with integrated ClipX measuring amplifier
- High measurement accuracy (0.01 %) and TEDS technology (Plug & Measure), with stored working standard calibration certificate
- Fast signal conditioning (19 kHz), high resolution and measurement bandwidth
- System with up to 7 sensor input technologies and configurable calculation channels
- Simple operation via integrated web server and data viewer for data logging
- Compact, fanless design with protection class IP65 (front) with Gorilla Glass, suitable for disinfection, fall-proof up to 1 m height

FUNCTION OVERVIEW



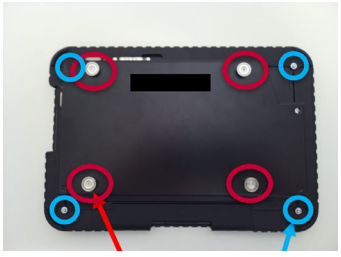
Notice:
Numbers in circles denote sample rates, not bandwidths.

INSTALLATION AND OPERATING VARIANTS

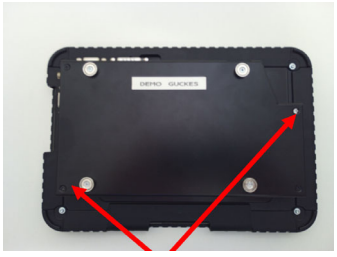
Desktop operation

With magnetic feet

Panel operation



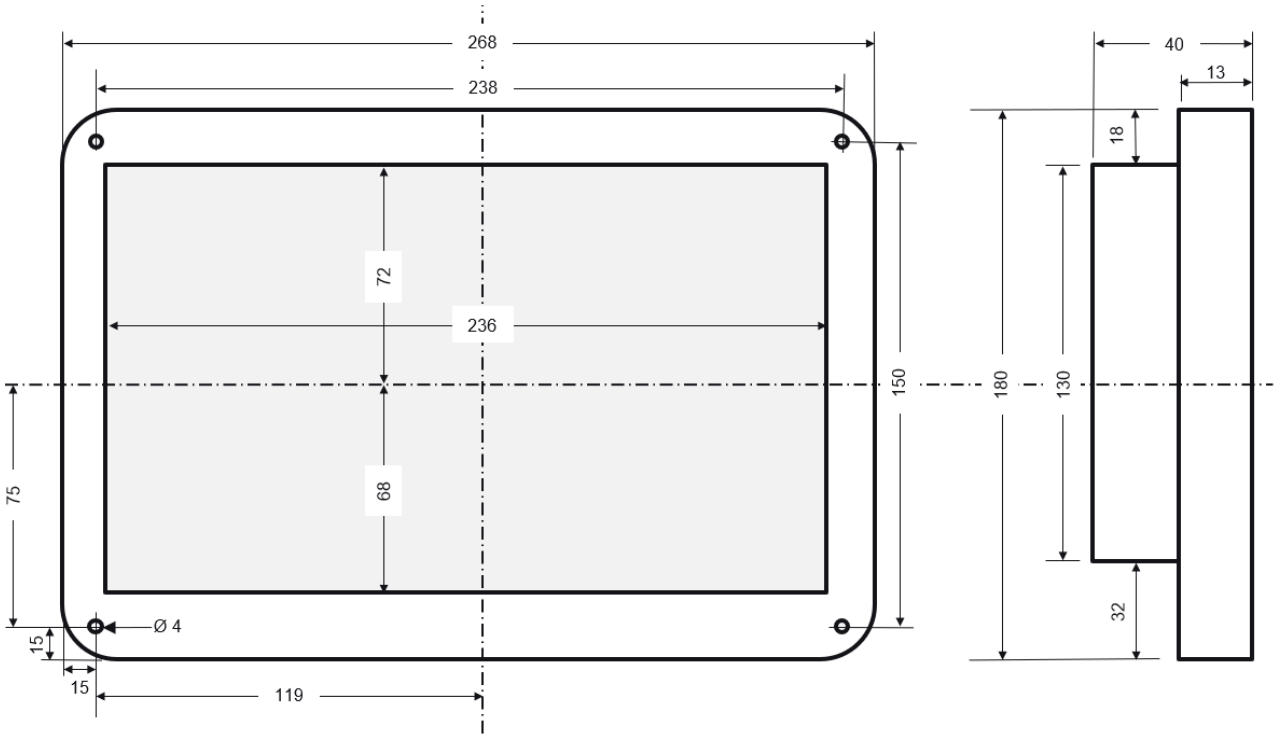
4 magnetic feet (red) and
4 screws (M2.5x8 mm,
blue) for panel mounting



2 sealed screws to detect
unauthorized opening

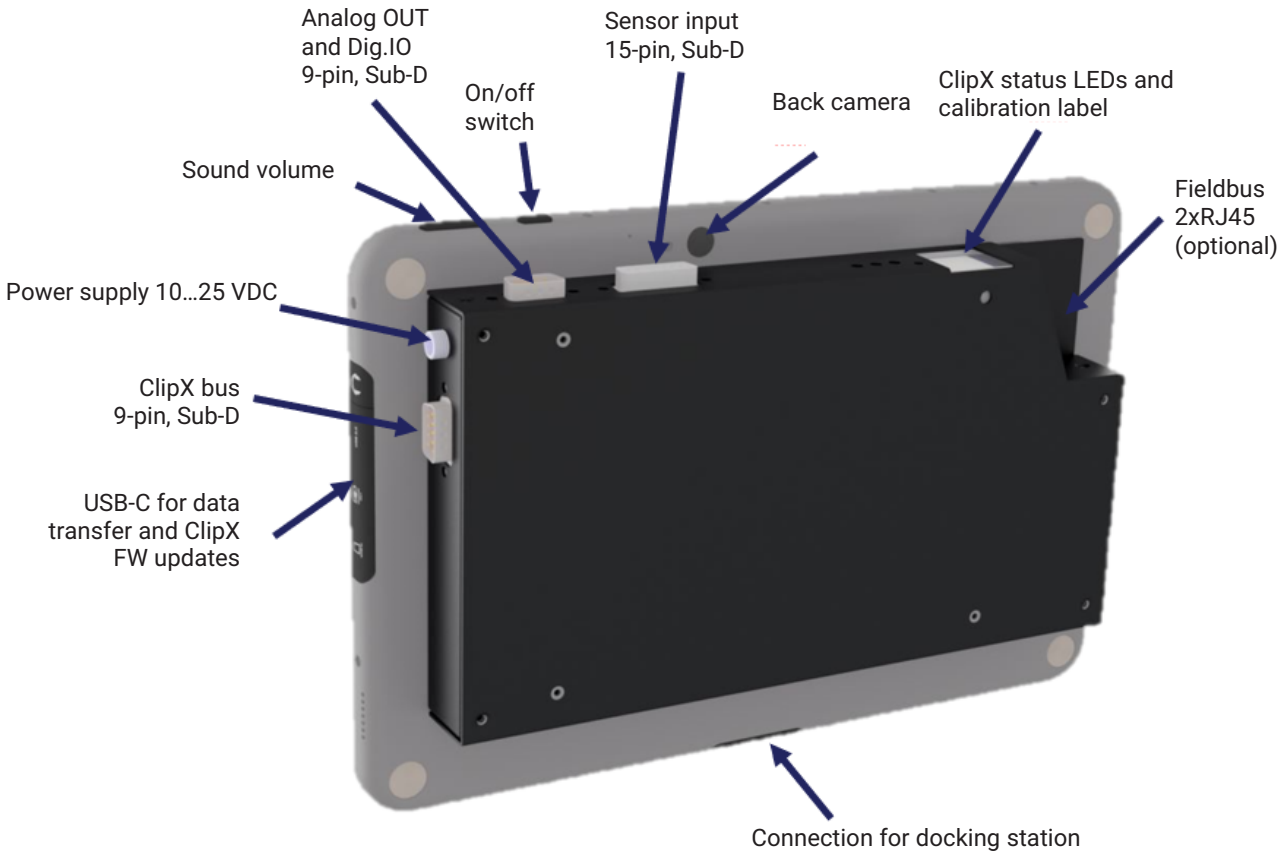
Rubber frame (option)

DIMENSIONS OF CUTOUT IN PANEL-FRAME



Dimensions in mm

PORTS AND FUNCTIONS



Sensor inputs

Designation	Pin assignment Sub-D socket (15-pin)
PT100	9
TEDS (1-wire)	10
Inner cable shield	11
Measurement signal - (4)	15
Measurement signal + (1)	8
Sense lead - (2')	12
Bridge excitation voltage - (2)	5
Sense lead + (3')	13
Bridge excitation voltage + (3)	6
Outer cable shield	Housing Sub-D socket
Analog input GND (I/U)	3
I in	2
U in	1
+Ub (supply to ext. sensor)	4
0V (ext. sensor)	7

Digital inputs and outputs and analog output

Designation	Pin assignment Sub-D socket ClipX bus connection (9-pin)
Digital output 1	1
Digital output 2	2
Digital input 1	3
Digital input 2	4
Digital input GND	5
Cable shield	6
Analog output GND	7
Analog output (U/I)	8

Measuring instrument bus (ClipX bus)

Designation	Pin assignment Sub-D socket ClipX bus connection (9-pin)
ClipX bus (-)	1
ClipX bus GND	2
ClipX bus (+)	3
Cable shield	Housing Sub-D socket

ScoutX SPECIFICATIONS

Display	10.1" (25.65 cm) capacitive 10-finger multi-touch display with Corning Gorilla Glass (2,560 x 1,600 px)
Processors	Intel® Atom™ x5-E3940 (4x 1.60 GHz up to 1.80 GHz, 2M Cache), Intel® HD Graphics 500
Operating system	Windows 10 IoT Enterprise
Software	Microsoft Edge browser for ClipX web server, ClipX Data-Viewer for visualization and data recording (pre-installed)
RAM	4 GB RAM DDR4 PC2133 (soldered)
Flash memory	64 GB EMMC power-saving flash memory
Cameras	8 MP camera with flash (rear), 2 MP camera (front)
Function interfaces	WLAN, Bluetooth, GPS/GLONASS, RFID, NFC
Interfaces	1x USB 3.1 Type-C™ (data transfer) and dock
Supply voltage range	10 … 25 VDC (rated 24 V)
Supply voltage interruption (based on PLC standard DIN EN 61131-2)	24 V (-10 %) 10 ms 12 V (-10 %) 1 ms
Operating temperature	-20°C … +50°C
Cooling	Fanless, very low heat generation, cooling is purely passive via the housing surface
Storage temperature	-20°C … +60°C
Humidity	10 % … 90 %
Equipment protection level	IP65 (splashing water on front, IP20 on back)
Dimensions	268 x 180 x 40 mm (W x H x D)
Total weight	approx. 1400 g (with ClipX)
Drop protection	1.2 meters, up to 1.8 meters (with optional rubber frame)
Installation	Mounting points for panel and tube mounting, and magnetic feet (supplied) on back

TEST AND MEASURING EQUIPMENT SPECIFICATIONS (ClipX)

General specifications		BM40, BM40PB, BM40IE
Measurement input	Number	1, galvanically isolated to supply
Transducer technologies		Full and half bridge strain gages, piezoresistive sensors (voltage-fed), potentiometric transducers, resistance thermometers (Pt100), electric voltage (±10V), electric current (±20mA)
A/D conversion	bit	32, delta-sigma converter
Sample rate	S/s	19200
Signal bandwidth (-3 dB)	Hz	Direct voltage sensor excitation (DC): 3800 Hz when filter off Carrier frequency sensor excitation (CF): 200 Hz
Active low-pass filter	Hz	Bessel or Butterworth 6th order, IIR DC: 0.02 … 3000; filter OFF (3800) CF: 0.02 … 200
Transducer identification		TEDS, IEEE 1451.4
Supported variants		Zero-wire TEDS and 1-Wire TEDS
TEDS module pitch, max.	m	100
ClipX bus (data transfer)		
Number of devices, max.		6
Data transfer		1 data value (measured value, calculated value, etc.) with status
Transmission speed	kHz	1, with automatic synchronization
Protocol / Addressing		RS485, node 1 … 6
Cabling		Wires, twisted in pairs and shielded
Distance between 2 modules, max.	cm	30
Real-time calculation in the device		
Calculation channels	Number	6
Update rate	ms	1
Functions		Matrix calculation (2x2 ... 6x6), multiplexer 4:1, tolerance window, peak value with hold, trigger, checkweigher, moving average/RMS, mechanical work, Bessel and Butterworth filter (IIR), FIR filter, comb filter, algebra (+ - * /), counter, differentiator, coordinate transformation (Cartesian ↔ Polar), PID controller, logic functions (AND, OR, NAND, NOR, XOR, XNOR, NOT), signal generator, pulse width measurement, timer, standstill recognition
Peak-value memory		
Number		3 Min, Max or Peak-to-Peak
Reference level		All measurement signals, all calculation channels, data from ClipX bus, fieldbus and Ethernet, analog output
Typical response time	µs	52
Limit switches		
Number		4
Reference level		All measurement signals, all calculation channels, data from ClipX bus, fieldbus and Ethernet, analog output
Function		Exceeding or falling below a level Inside/outside a tolerance band
Typical response time	µs	300

General specifications		BM40, BM40PB, BM40IE
Digital inputs		
Number		2
Function		Zero, Tare, Reset Limit Value, Digital output, Toggle Parameter Sets (bit-coded), Flags for Calculated Channels
Typical response time	ms	1
Digital outputs		
Number		2
		Designed as high-side switches
Function		Limit value, digital input, measured value/system status, fieldbus flag, current parameter set number (bit-coded), calculation channel flags and Ethernet flags
Typical response time	ms	1
Parameter sets		
Number		10
		Sensor settings, measurement acquisition incl. computation channels, limit values, digital input/output settings, analog output settings.
Device cloning		All the device settings can be saved in full to a PC as a backup and reloaded, either with or without Ethernet and fieldbus settings.
Switching time		<100 ms plus settling time of low-pass filter; The measured value status is set to 'invalid' for 2.5 seconds so as to suppress transient responses.
ClipX internal device storage		
Freely usable	Mbyte	8
Data memory (FIFO)		4,000 values of max. 6 signals, measured values, peak values, calculated values, values from fieldbus or Ethernet, from own ClipX or from other ClipX transmitted via ClipX bus.
Additional content		Own calibration certificate, manufacturer's certificate 2.1 according to EN 10204, device description files for the fieldbuses (BM40IE only); Windows PC software ClipX Data-Viewer (with scope and data storage function).

Strain gage full bridge		BM40, BM40PB, BM40IE
Accuracy class		0.01
Transducers that can be connected		Full bridge strain gages
Transducer impedance	Ω	80 … 5000
Measurement ranges (at 5 V bridge excitation)	mV/V	2.5 or 5, reversible
Bridge excitation voltage	V	5 (±10%), direct voltage (DC) or carrier frequency (CF) 1200 Hz reversible
Signal bandwidth (-3 dB)	Hz	DC: 0 … 3800 CF: 0 … 200
Permissible cable length between ClipX and transducer	m	< 100
Transducer identification		TEDS, IEEE 1451.4; optionally 1-wire technology with separate TEDS module or HBM zero-wire technology with TEDS module in the sense leads of the sensor
Noise (peak-to-peak) at 25 °C, excitation 5 V (DC), 350 Ohm-Full bridge		
With 1 Hz Bessel filter	µV/V	0.04
With 10 Hz Bessel filter	µV/V	0.12
With 100 Hz Bessel filter	µV/V	0.4
With 1 kHz Bessel filter	µV/V	1.2

Strain gage full bridge		BM40, BM40PB, BM40IE
Noise (peak-to-peak) at 25 °C, excitation 5 V (CF), 350 Ohm-Full bridge		
With 1 Hz Bessel filter	µV/V	0.05
With 10 Hz Bessel filter	µV/V	0.16
With 100 Hz Bessel filter	µV/V	0.5
With 200 Hz Bessel filter	µV/V	0.8
Non-linearity	%	0.005 of full scale value
Zero drift (5 V excitation)	%/10 K	0.01 of full scale value
Full scale drift (5 V excitation)	%/10 K	0.01 of measured value
Full bridge strain gage with Zener barriers		
Accuracy class		
at 80 Ω transducer impedance, 6-wire configuration, max. 100 m cable length and DC or CF		0.2
at 350 Ω transducer impedance, 6-wire configuration, max. 100 m cable length and DC or CF		< 0.05
at 350 Ω … 5 kΩ transducer impedance, 6-wire configuration, max. 100 m cable length and DC		0.05

Half bridge strain gage		BM40, BM40PB, BM40IE
Accuracy class		0.1
Transducers that can be connected		Strain gage half bridges
Transducer impedance	Ω	80 … 5000
Measurement ranges (at 5 V bridge excitation)	mV/V	2.5 or 5; reversible
Bridge excitation voltage	V	5 (±10%), direct voltage (DC) or carrier frequency (CF) 1200 Hz reversible
Signal bandwidth (-3 dB)	Hz	DC: 0 … 3800 CF: 0 … 200
Permissible cable length between ClipX and transducer	m	< 100
Transducer identification		TEDS, IEEE 1451.4; optionally 1-wire technology with separate TEDS module or HBM zero-wire technology with TEDS module in the sense leads of the sensor
Noise (peak-to-peak) at 25 °C, excitation 5 V (DC), 350 Ohm-Half bridge		
With 1 Hz Bessel filter	µV/V	0.08
With 10 Hz Bessel filter	µV/V	0.24
With 100 Hz Bessel filter	µV/V	0.8
With 1 kHz Bessel filter	µV/V	2.4
Noise (peak-to-peak) at 25 °C, excitation 5 V (CF), 350 Ohm-Half bridge		
With 1 Hz Bessel filter	µV/V	0.1
With 10 Hz Bessel filter	µV/V	0.32
With 100 Hz Bessel filter	µV/V	1
With 200 Hz Bessel filter	µV/V	1.6
Non-linearity	%	0.05 of full scale value
Zero drift (5 V excitation)	%/10 K	0.1 of full scale value
Full scale drift (5 V excitation)	%/10 K	0.1 of measured value

Resistive full bridge		BM40, BM40PB, BM40IE
Accuracy class		0.01
Transducers that can be connected		Resistive full bridge, voltage-fed

Resistive full bridge		BM40, BM40PB, BM40IE
Transducer impedance	Ω	80 … 5000
Measurement ranges (at 5 V bridge excitation)	mV/V	100 or 800, reversible
Bridge excitation voltage	V	5 (± 10%), direct voltage (DC)
Signal bandwidth (-3 dB)	Hz	DC: 0 … 3800
Permissible cable length between ClipX and transducer	m	< 100
Transducer identification		TEDS, IEEE 1451.4; optionally 1-wire technology with separate TEDS module or HBM zero-wire technology with TEDS module in the sense leads of the sensor
Noise (peak-to-peak) at 25 °C, at 100 mV/V, excitation 5 V (DC), 350 Ohm-Full bridge		
With 1 Hz Bessel filter	µV/V	0.2
With 10 Hz Bessel filter	µV/V	0.4
With 100 Hz Bessel filter	µV/V	1.5
With 1 kHz Bessel filter	µV/V	5
Noise (peak-to-peak) at 25 °C, at 800 mV/V, excitation 5 V (DC), 350 Ohm-Full bridge		
With 1 Hz Bessel filter	µV/V	0.6
With 10 Hz Bessel filter	µV/V	1.2
With 100 Hz Bessel filter	µV/V	4.5
With 1 kHz Bessel filter	µV/V	15
Non-linearity	%	0.005 of full scale value
Zero drift (5 V excitation)	%/10 K	0.01 of full scale value
Full scale drift (5 V excitation)	%/10 K	0.01 of measured value

Potentiometric transducers/potentiometers		BM40, BM40PB, BM40IE
Accuracy class		0.1
Transducers that can be connected		Potentiometric transducers
Transducer impedance	Ω	80 … 5000
Measurement ranges (at 5 V bridge excitation)	mV/V	500, corresponding to 0 … 100 %
Bridge excitation voltage	V	5 (± 10%), direct voltage (DC)
Signal bandwidth (-3 dB)	Hz	DC: 0 … 3800
Permissible cable length between ClipX and transducer	m	< 100
Transducer identification		TEDS, IEEE 1451.4; 1-wire technology with separate TEDS module
Noise (peak-to-peak) at 25 °C, potentiometer, excitation 5 V (DC), 10 kΩ potentiometer, mid position		
With 1 Hz Bessel filter	%	0.00008
With 10 Hz Bessel filter	%	0.00025
With 100 Hz Bessel filter	%	0.001
With 1 kHz Bessel filter	%	0.003
Non-linearity	%	0.05 of full scale value
Zero drift (5 V excitation)	%/10 K	0.1 of full scale value
Full scale drift (5 V excitation)	%/10 K	0.1 of measured value

Resistance thermometers (Pt100)		BM40, BM40PB, BM40IE
Accuracy	°C	0.5
Transducers that can be connected		Pt100 (connected in 3-wire configuration)
Linearization range	°C	-200 … +850
Signal bandwidth (-3 dB)	Hz	DC: 0 … 3800

Resistance thermometers (Pt100)		BM40, BM40PB, BM40IE
Permissible cable length between ClipX and transducer	m	< 100
Transducer identification		TEDS, IEEE 1451.4; 1-wire technology with separate TEDS module
Noise (peak-to-peak) at 25 °C, Pt100 at 100 Ohm		
With 1 Hz Bessel filter	K	0.008
With 10 Hz Bessel filter	K	0.012
With 100 Hz Bessel filter	K	0.06
With 1 kHz Bessel filter	K	0.2
Non-linearity	%	< 0.5
Zero drift	K / 10 K	< 0.2
Full-scale drift	K / 10 K	< 1

Voltage		BM40, BM40PB, BM40IE
Accuracy class		0.05
Transducers that can be connected		Voltage sources
Transducer impedance	MΩ	> 1
Measuring range	V	±10
Signal bandwidth (-3 dB)	Hz	DC: 0 … 3800
Permissible cable length between ClipX and transducer	m	< 100
Transducer identification		TEDS, IEEE 1451.4; 1-wire technology with separate TEDS module
Noise at voltage input ±10 V		
With 1 Hz Bessel filter	mV	0.05
With 10 Hz Bessel filter	mV	0.10
With 100 Hz Bessel filter	mV	0.25
With 1 kHz Bessel filter	mV	0.75
Common-mode rejection		
for DC common mode	dB	> 120
for 50/60 Hz common mode, typical	dB	> 80
Common-mode voltage, max. (to housing and supply ground)	V	±30
Non-linearity	K	0.05 of full scale value
Zero drift	K / 10 K	0.05 of full scale value
Full-scale drift	K / 10 K	0.05 of measured value

Signal current		BM40, BM40PB, BM40IE
Accuracy class		0.05
Transducers that can be connected		Transducers with current output
Measuring resistance value, typical	Ω	< 15
Measuring range	mA	4 … 20, ±20 mA, reversible
Signal bandwidth (-3 dB)	Hz	DC: 0 … 3800
Permissible cable length between ClipX and transducer	m	< 100
Transducer identification		TEDS, IEEE 1451.4; 1-wire technology with separate TEDS module
Noise at current input ±20 mA		
With 1 Hz Bessel filter	µA	0.05
With 10 Hz Bessel filter	µA	0.1
With 100 Hz Bessel filter	µA	0.5
With 1 kHz Bessel filter	µA	2

Signal current		BM40, BM40PB, BM40IE
Common-mode rejection for DC common mode for 50/60 Hz common mode, typical	 dB dB	 > 120 > 80
Common-mode voltage, max. (to housing and supply ground)	 V	 ±30
Non-linearity	%	0.05 of full scale value
Zero drift	K / 10 K	0.05 of full scale value
Full-scale drift	K / 10 K	0.05 of measured value

Input / Output

Analog output		BM40, BM40PB, BM40IE
Voltage output		
Accuracy class		0.05
Number		1
Signal sources		All measurement signals, all calculation channels, data from ClipX bus, fieldbus and Ethernet
Output signal	V	±10; reversible, short-circuit proof
D/A converter resolution	bit	16
Output rate, max.	kHz	19.2
Cut-off frequency (-3 dB)	kHz	2
Output resistance	Ω	< 320
Permissible input impedance		10 kΩ II 20 nF
Permissible cable length, max.	m	100
Noise (peak-to-peak)	mV	< 10
Integral Non Linearity (INL)	LSB	<±27
Zero drift rel. to full scale	mV / 10 K	< 2
Full-scale drift rel. to output value	mV / 10 K	< 2
Current output		
Accuracy class		0.05
Number		1
Signal sources		All measurement signals, all calculation channels, data from ClipX bus, fieldbus and Ethernet
Output signal	mA	4 … 20 mA, reversible, short-circuit proof
D/A converter resolution	bit	16
Output rate, max.	kHz	19.2
Cut-off frequency (-3 dB)	kHz	2
Permitted burden	Ω	< 400
Permissible cable length, max.	m	100
Noise (peak-to-peak)	µA	< 60
Integral Non Linearity (INL)	LSB	<±27
Zero drift rel. to full scale	µA / 10 K	< 5
Full-scale drift rel. to output value	µA / 10 K	< 10

Digital inputs		BM40, BM40PB, BM40IE
Number		2
Functions		Zero, Tare, Reset Limit Value, Digital output, Toggle Parameter Sets (bit-coded), Flags for Calculated Channels

Digital inputs		BM40, BM40PB, BM40IE
Switching time	ms	< 1
Input signal range	V	0 … 30
Maximum permitted input signal range	V	30
Low state input	V	0 … 5 (or open)
High state input	V	10 … 30
Input resistance (nominal)	kΩ	2.4
Cable length, max.	m	100
Cable type (required in the event of interference)		shielded

Digital outputs		BM40, BM40PB, BM40IE
Number		2, short-circuit proof
Functions		Limit value, digital input, measured value/system status, fieldbus flag, current parameter set number (bit-coded), calculation channel flags
Switching time	ms	< 1
Input voltage	V	Operating voltage
Output current per output, max.	mA	200
Output current (outputs total), max.	mA	400
Output impedance	Ω	< 1
Start-up behavior		Low until the ClipX transmits the required level

Ethernet access

Access method and parameters		BM40, BM40PB, BM40IE
Maximum number of connections (including in parallel)		2 x web server, 1 x TCP/IP, 2 x OPC UA
Direct access via Ethernet (TCP/IP)		starting with firmware 1.2
Port		55000
Access method		SDO read and write commands, access to ClipX FIFO
OPC UA Server		Starting with hardware 2.0 and firmware 1.4 or higher
Profiles		Micro
Transport		TCP/IP binary
Security		User name and password
Methods		Supported
Historical data access		Not supported
Number of sessions		2
Subscriptions per session		1
Items per subscription		6
Item queue size		10
Minimum publishing interval	ms	100
Minimum sample interval	ms	20
PPMP protocol		starting with firmware 2.8
Specification		https://www.eclipse.org/unide/specification/
Type of message		Measured data message V2
Protocol and polling method		HTTP/1.1 POST
Content type		json
Sampling interval (for measured values)	ms	10 … 60000, adjustable in 10 ms increments
Transmission interval (for packet with measured values)	ms	100 … 60000
Measured values per channel and HTTP packet		max. 100

Access method and parameters		BM40, BM40PB, BM40IE
Number of measured values per packet		max. 600
Number of transmitted channels		1 … 6
Resolution of values	Number of digits	1 … 6, individually adjustable per channel

Fieldbuses

PROFIBUS		BM40PB
Bit rate	kBit/s	9.6 … 12000 auto-detect
Node address		3 … 126 adjustable via web user interface Factory setting: 126
Configuration data, max.	bytes	244
Logical slots		30
Cyclic output data (master -> ClipX), max.	bytes	160
Cyclic input data (ClipX -> master), max.	bytes	160
Cycle time (slave interval), min.	ms	0.6
Acyclic data protocol		DP V1 Class 1 and Class 2 A list with the data objects can be downloaded via the web user interface
Acyclic data, max.	bytes	240
Plug		D-Sub 9-pin; galvanically isolated from supply and measurement ground
PROFIBUS Ident No.		0x1015

Industrial Ethernet IE		BM40IE
The operator can switch fieldbus type in the BM40IE via the ClipX web server		
EtherCAT®[1)]		
Type		EtherCAT complex slave
Cable type		Standard Cat-5, shielded
Cable length, max.	m	100
Connector socket		2x RJ45 (IN / OUT)
Hot-plug possible		Yes
Input data, max.	bytes	166
Output data, max.	bytes	44
Online device description		CAN over EtherCAT Object Dictionary (ESI file not required)
Offline device description		ESI file stored in the device
Data transfer rate, max.	kHz	4
Distributed clocks Minimum cycle time	 µs	Supported, 32 bits 250
EtherNet/IP™[2)]		
Type		Communication adapter
Cable type		Standard Cat-5, shielded
Cable length, max.	m	100
Connector socket		2 x RJ45
Input data, max.	bytes	166
Output data, max.	bytes	44
IO connection types		Exclusive owner, Listen only, Input only

Industrial Ethernet IE		BM40IE
IO connection trigger types		Cyclic, minimum 1 ms[3)], Application triggered, minimum 1 ms[3)], Change of state, minimum 1 ms[3)]
Explicit messages connections		10
Implicit messages connections		5
Unconnected Message Manager (UCMM)		10
Configuration control		STATIC, BOOTP, DHCP
Bit rates	Mbit/s	10, 100
Duplex modes		Half, full, auto negotiation
Data transport layer		Ethernet II, IEEE 802.3
Address collision detection		Supported
Device level ring		Supported
Integrated switch		Supported
Reset services		Type 0, type 1
Quick connect		not supported
Tags		not supported
CIP sync		not supported

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

2) EtherNet/IP™ is a trademark of ODVA Inc. For more information regarding ODVA, visit www.odva.org.

3) Depends on the number of connections and the IO quantities.

PROFINET		
Cable type		Standard Cat-5, shielded
Cable length, max.	m	100
Connector socket		2x RJ45 (port1 / port 2)
Realtime classes		1 (“RT”) / 3 (“IRT”)
Device access point “slow”		
Cycle time Class 1	ms	1 / 2 / 4
Cycle time Class 3	ms	1 / 2 / 4
Slots / max. number of modules	-	30
Input data, max.	bytes	180
Output data, max.	bytes	100
Device access point “fast”		
Cycle time Class 1	ms	1 / 2 / 4
Cycle time Class 3	ms	0.25 / 0.5 / 1 / 2 / 4
Slots / max. number of modules		6
Input data, max.	bytes	60
Output data, max.	bytes	40
Supported protocols		RTC (Real Time Cyclic) Class 1, unsynchronized Class 3, synchronized
		RTA - Real Time Acyclic
		DCP - Discovery and Configuration
		DCE/RPC - Distributed Computing Environment - Connectionless Remote Procedure Calls
		LLDP - Link Layer Discovery Protocol
		PTCP - Precision Transparent Clock Protocol
		SNMP - Simple Network Management Protocol
Media redundancy		MRP client

Identification & maintenance		I&M0 … I&M3 read and write
Modbus TCP		
Cable type		Standard Cat-5, shielded
Cable length, max.	m	100
Connector socket		2 x RJ45
Bit rates	Mbit/s	10, 100
Maximum number of connections		16
Function codes	FC 1 FC 2 FC 3 FC 4 FC 5 FC 6 FC 15 FC 16 FC 23	Read coils Read input discretes Read multiple registers Read input registers Write coil Write single register Force multiple coils Write multiple registers Read/Write multiple registers
Maximum number of registers per write telegram	FC 3, 4, 23	125
Maximum number of registers per write telegram	FC 16	123
Maximum number of registers per write telegram	FC 23	121
Maximum number of coils per read telegram	FC 1, 2	2000
Maximum number of coils per write telegram	FC 15	1968

SIGNAL DELAYS (ms)

The following table contains the phase delays of the A/D converter plus digital filter. Some filter frequencies are only possible with a DC amplifier. The bandwidth with DC and the digital filter switched off (Filter OFF) is 3800 Hz. The filter phase delay is then 0 ms, meaning the phase delay of the A/D converter with no filter is 260 µs.

Cut-off frequency in Hz (-3 dB)	Phase delay with Bessel filter in ms	Phase delay with Butterworth filter in ms
3000 (DC only)	0.403	0.480
2500 (DC only)	0.432	0.524
2000 (DC only)	0.475	0.590
1500 (DC only)	0.547	0.700
1000 (DC only)	0.690	0.920
800 (DC only)	0.798	1.085
750 (DC only)	0.833	1.140
600 (DC only)	0.977	1.360
500 (DC only)	1.120	1.580
400 (DC only)	1.335	1.910
350 (DC only)	1.489	2.146
280 (DC only)	1.796	2.617
250 (DC only)	1.980	2.900
200	2.410	3.560
160	2.948	4.385
150	3.127	4.660
120	3.843	5.760
100	4.560	6.860
80	5.635	8.510

Cut-off frequency in Hz (-3 dB)	Phase delay with Bessel filter in ms	Phase delay with Butterworth filter in ms
75	5.993	9.060
60	7.427	11.260
50	8.860	13.460
40	11.010	16.760
35	12.546	19.117
30	14.593	22.260
25	17.460	26.660
20	21.760	33.260
16	27.135	41.510
15	28.927	44.260
12	36.093	55.260
10	43.260	66.260
8	54.010	82.760
3.5	123.12	188.83
3	143.59	220.26
2.5	172.26	264.26
2	215.26	330.26
1.6	269.01	412.76
1.2	358.59	550.26
1	430.26	660.26
0.8	537.76	825.26
0.75	573.59	880.26
0.6	716.93	1100.26
0.5	860.26	1320.26
0.4	1075.26	1650.26
0.35	1228.83	1885.97
0.28	1535.97	2357.40
0.25	1720.26	2640.26
0.2	2150.26	3300.26
0.16	2687.76	4125.26
0.15	2866.93	4400.26
0.1	4300.26	6600.26
0.075	5733.59	8800.26
0.05	8600.26	13200.26
0.035	12286.0	18857.4
0.025	17200.3	26400.3
0.02	21500.3	33000.3
7.5	57.593	88.260
6	71.927	110.260
5	86.260	132.260
4	107.76	165.26

Group 1: Measured values

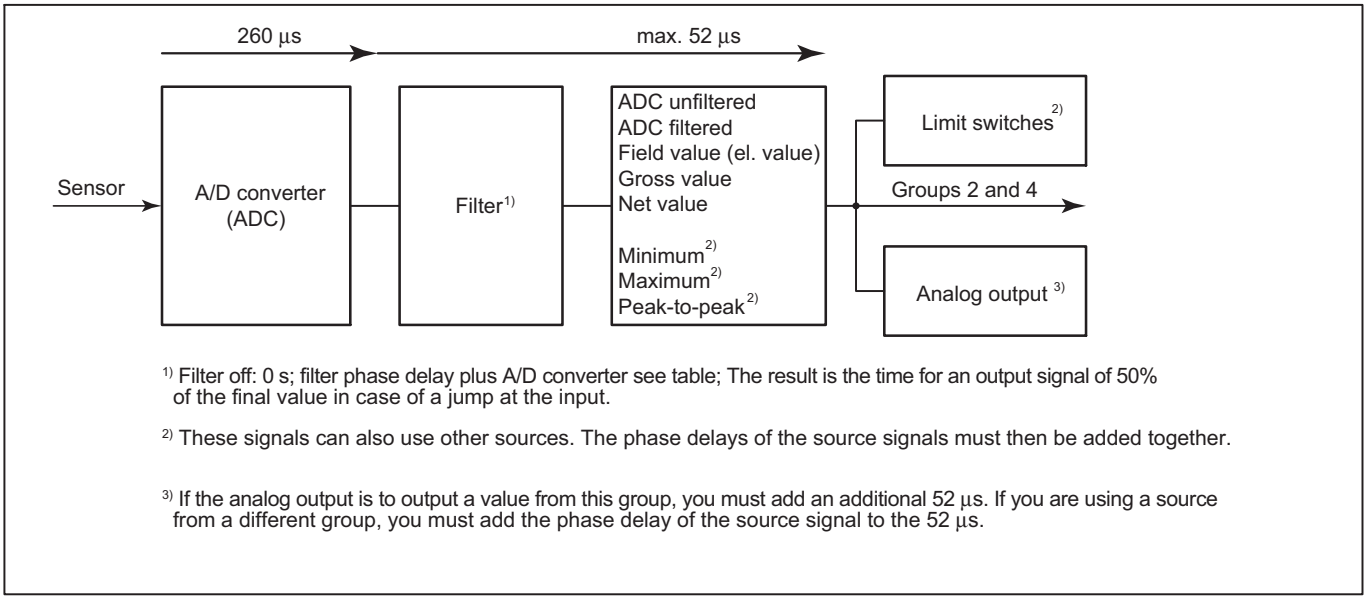


Fig. 1: Minimum phase delays for group 1: 52 µs plus A/D converter conversion time plus filter phase delay

Some signals might also have sources from other groups. For example, the analog output might deliver a signal from the ClipX bus. In these cases, you must add the propagation time of the source signal's group in order to get the total propagation time.

Example 1

Phase delay from input, e.g. 10 V, 20 mA or DC full/half bridge, to analog output (10 V) with a Bessel filter at 1 kHz:

A/D converter (ADC) plus filter: 690 µs.
Added to this is a jitter of up to 52 µs, as the A/D converter is not synchronized with group 1.
Group 1: 690 µs + 52 µs max.
Analog output: 52 µs.

So the total phase delay is 742 … 794 µs.

Group 2: Flags, Digital I/Os, calculated values, ClipX bus

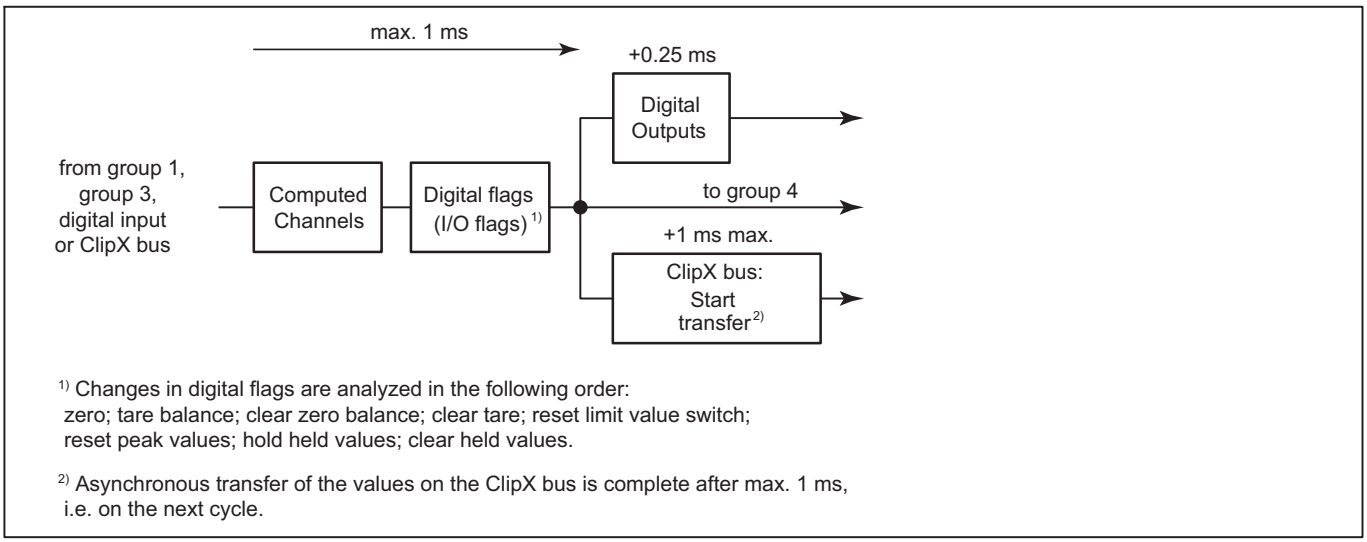


Fig. 2: Maximum phase delay for group 2: 1 ms

Example 2

Phase delay from input (see group 1) to a digital output with a Bessel filter at 1 kHz, limit switch at half the step height.

A/D converter (ADC) plus filter: 690 µs.
Added to this is a jitter of up to 52 µs, as the A/D converter is not synchronized with group 1.
Group 1: 690 µs + 52 µs max.
Group 2: 1 ms
Digital output: max. 250 µs response time

In the best case, a value is available at the start of the analysis in group 2 and can be outputted directly at the digital output. So the total phase delay is 940 … 1992 µs.

Example 3

Phase delay of a value from the ClipX bus via a limit switch to a digital output.

Group 2: 1 ms max.
Digital output: 250 µs response time.

In the best case, a value is available at the start of the analysis in group 2 and can be outputted directly at the digital output. However, you must add the phase delay in the device that places the value on the ClipX bus in order to get the time from the sensor until a response occurs: 1.69 ms min. and 2.742 ms max. with 1 kHz Bessel filter. So the total phase delay is 1.94 … 3.992 ms.

Group 3: Data from fieldbus master to ClipX

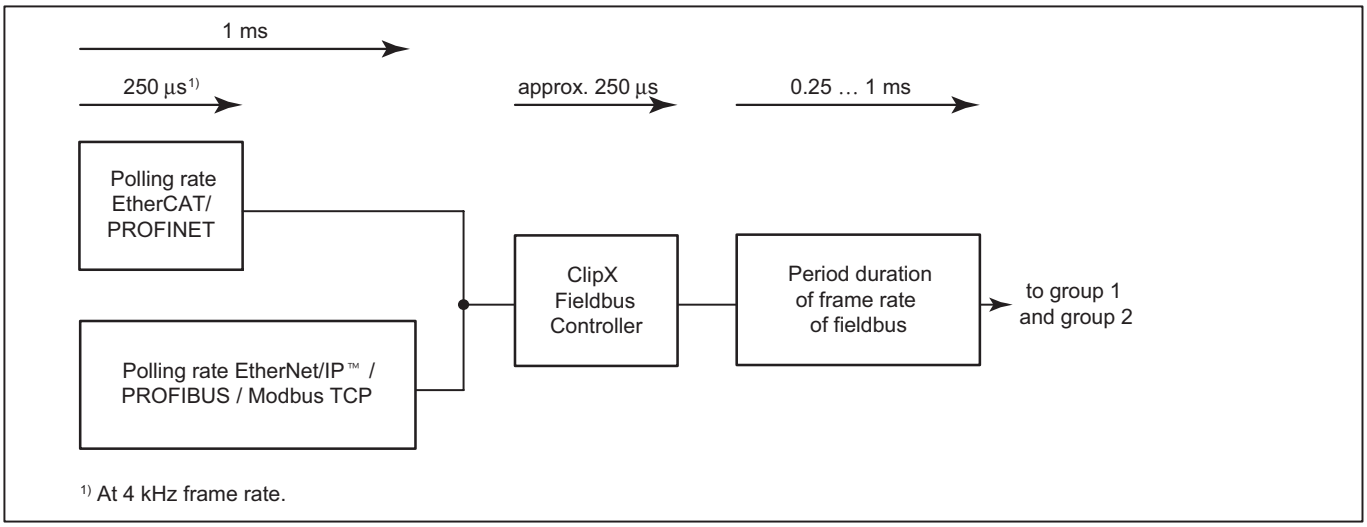


Fig. 3: Phase delay for group 3

Example 4

Signal delay from fieldbus master (PLC) to ClipX. From there it can be further processed or outputted as an analog signal.

Fieldbus output for EtherCAT or PROFINET (4 kHz frame rate): 250 µs + 250 µs + 250 µs = 750 µs.
After this time the signal is available in the ClipX.

If you want to output the signal via the analog output of this ClipX, 52 µs is added (group 1), i.e. the total phase delay is then 802 µs.

If you want to calculate the signal via an internal calculation channel before analog output, another millisecond is added, i.e. the total phase delay in this case is 1802 µs.

Group 4: Data from ClipX to fieldbus master

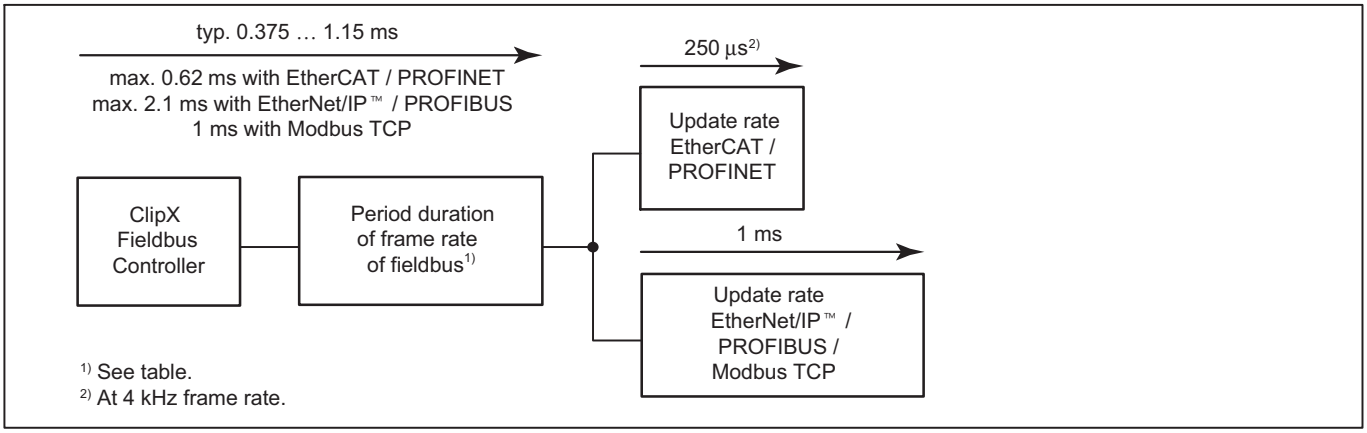


Fig. 4: Phase delay for group 4

Phase delays of group 4

Fieldbus	Data transfer in ms	Phase delay typ. in ms	Phase delay max. in ms
EtherCAT / PROFINET	0.25	0.25 + frame rate/2	0.37 + frame rate
EtherNet/IP™ / PROFIBUS	1	0.65 + frame rate/2	1.1 + frame rate
Modbus TCP	1	–	–

Example 5

Signal delay from the input (group 1) with a Bessel filter with 1 kHz to the fieldbus master (group 4).

A/D converter (ADC) plus filter: 690 µs.
Added to this is a jitter of up to 52 µs, as the A/D converter is not synchronized with group 1.
Group 1: 690 µs + 52 µs max.
Fieldbus output with EtherCAT or PROFINET (4 kHz frame rate): max. 370 µs + 250 µs + 250 µs (typ. 250 µs + 125 µs + 250 µs = 625 µs).

So the total phase delay is between 1.315 ms (min.) and 1.612 ms (max.).

Group overview

The following overview shows the correlations and phase delays of the four groups.

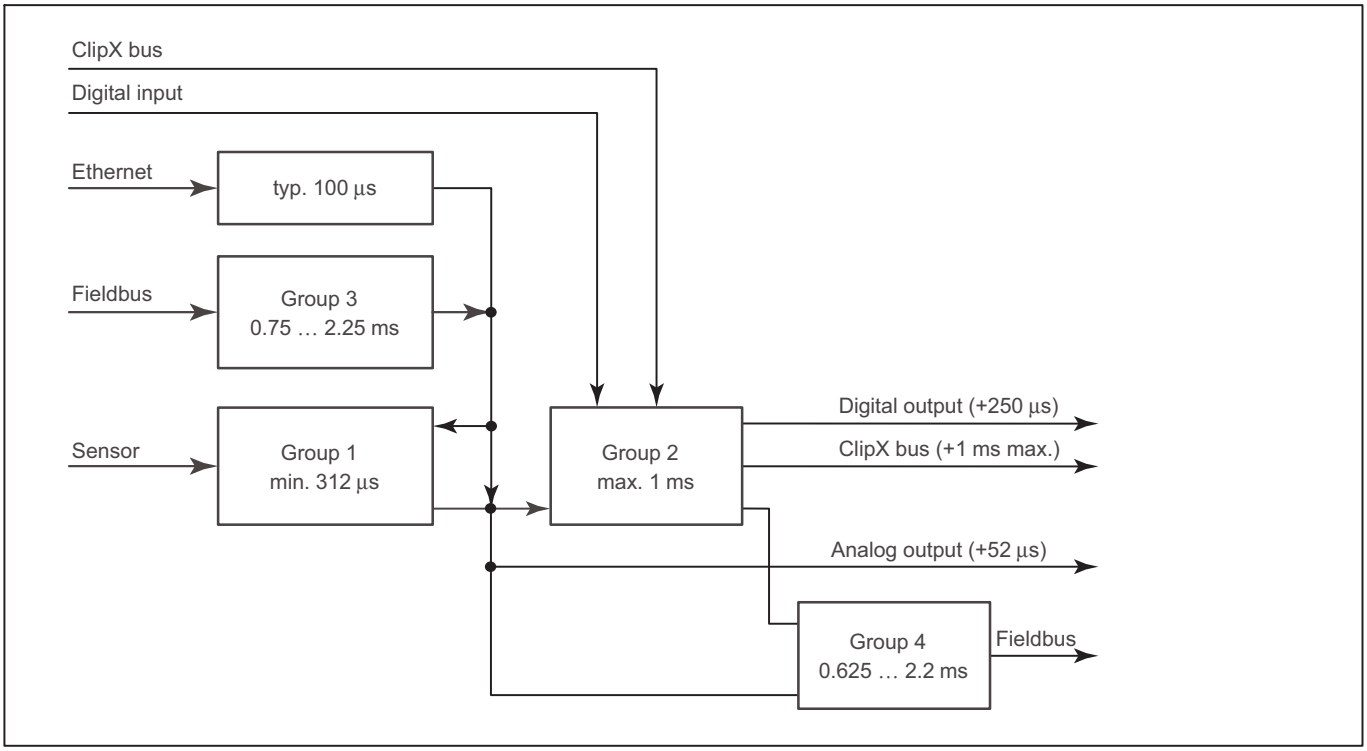


Fig. 5: All groups with inputs and outputs

SCOPE OF DELIVERY

- ScoutX tablet measuring amplifier
- Power supply 110/120VAC, 12VDC, 5A, 60W with screw socket for ScoutX

ACCESSORIES

Designation	Ordering number
Sensor connector 15-pin, Sub-D with housing and knurled screws	1-CON-P1024
Sensor connector 15-pin, Sub-D incl. TEDS 0-wire board with housing and knurled screws	1-TEDS-DB-15P
Plug 9-pin, Sub-D with housing and knurled screws for digital I/Os or ClipX bus	2-9278.0307
Ethernet cable Cat6A 2m, RJ45 on both sides for fieldbus or Ethernet connection	1-KAB239-2

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