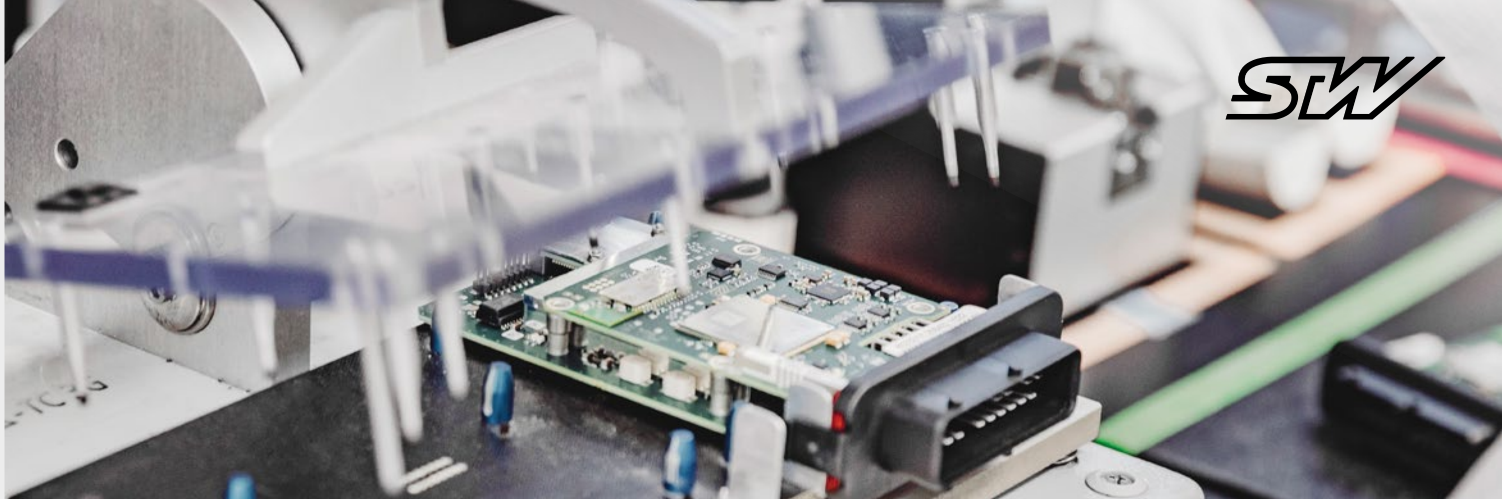


TCG.5

TCG data management and connectivity modules

KEY FEATURES

- 5G connectivity
- Embedded Linux for fast and easy development of applications
- Compatible with major cloud platforms
- Compliance with standards for the automotive, agricultural and construction machinery industries
- CRA ready and RED-DA compliant

TECHNICAL DATA

- i.MX quad core 128 GB Flash / 4 GB RAM
- 5G communication
- Dual-Mode V2X
- GPS, Galileo, BeiDou, GLONASS
- WiFi 6 / Bluetooth 5.3
- 4 CAN interfaces
- Ethernet 100BASE-TX,
  Single Pair Ethernet 4 x 1000BASE-T1 /
  1 x 10BASE-T1S

ACCESSORIES

- Mating plugs
- Breakout cable for development purposes
- Antennas for wireless communication interfaces
- Comprehensive tools, software, documentation, and examples

Sensor-Technik Wiedemann GmbH

Am Bärenwald 6
87600 Kaufbeuren
Germany

+49 8341 9505-0
info.stw@wiedemann-group.com
www.stw-mm.com

TECHNICAL DATA

Software data

Type	Features
Operation system	Yocto Linux / RTOS
Linux kernel version	6.x
Programming language	C/C++, Shell script, other programming languages available on request

System

Type	Features
Power supply	9 … 32 V DC
Battery (optional)	1-2 x GPS position per day for one month
Dimensions (L x W x H)	238 x 148 x 50 mm
Antenna connectors	Quad-Fakra (4x FAKRA ports)

Processor and memory

Type	Features
Processor	64 bit i.MX quad core A55
RAM	up to 4 GB
eMMC memory	up to 128 GB
RTC	Real time clock

Miscellaneous

Type	Features
Watchdog	Configurable watchdog
Temperature sensor	Measuring range -40 °C to +85 °C / -40 °F … +185 °F
Acceleration sensor	3-axis, measuring ranges ±2 g / ±4 g / ±8 g / ±16 g (configurable) System wake-up function (configurable)

Miscellaneous

Type	Features
Inertial Measurement Unit (IMU) (optional, instead of the acceleration sensor)	6-axis IMU (3-axis accelerometer + 3-axis gyroscope) Accelerometer ranges ±2 g / ±4 g / ±8 g / ±16 g (configurable) Gyro range ±400°/s, bias instability 1.5°/h, angle random walk 0.2°/√h, bandwidth 50 Hz System wake-up function (configurable)
Magnetic sensor (optional)	3-axis digital magnetic sensor, measurement range ±50 gauss
Signaling	Multicolor LED

Communication interfaces

Type	Quantity	Configuration
5G modem	1	Global external antenna: • Sub-6 GHz, 3GPP release 17, 220 Mbps DL / 100 Mbps UL
		SIM card options: • 2FF Mini SIM card, can be accessed through a clip at the side of the housing. • Alternative: MFF2 eSIM card, can be placed on the PCB (optional) • SMS - system wakeup function (optional)
GNSS	1	Standard: Dual-frequency GNSS (L1+L5)
		Option: Quad-frequency RTK GNSS (L1+L2+L5+E6) with IMU and heading, sub-centimeter precision, and 20 Hz update rate
WiFi / Bluetooth	1	WiFi 6
		Bluetooth 5.3
CAN	4	CAN 2.0 B, high / low-speed, max. 1 Mbps, listen-only mode possible
		CAN1 wakeup function (optional)

TECHNICAL DATA

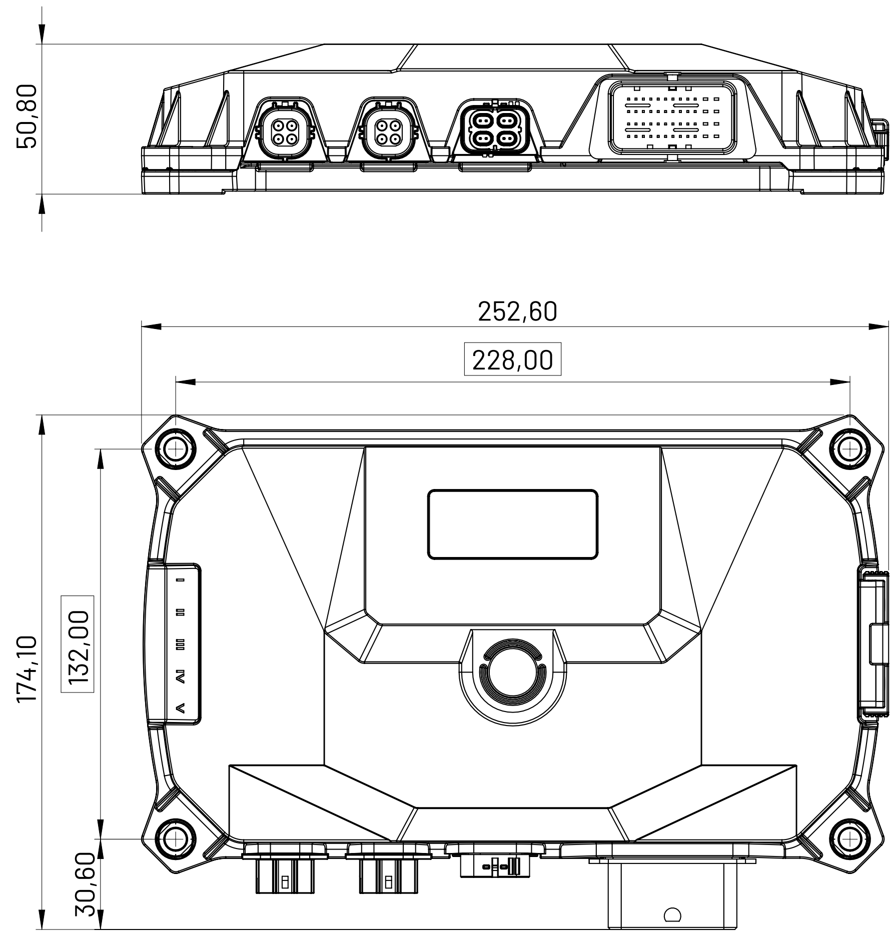
Communication interfaces

Type	Quantity	Configuration
RS232 / RS485	2	Serial interface with programmable baud rate up to 230,400 baud, 2nd interface configurable as RS485 (optional)
V2X	1	Option: Dual Radio V2X: Concurrent dual-channel operation (DSRC + 5G-V2X) supports DSRC (802.11p), LTE-V2X, 5G-V2X (Rel. 16/17/18), and IEEE 802.11bd
Ethernet	4	ETH 1 - 100/1000BASE-T1
	1	ETH 2 - 10BASE-T1S (optional)
	1	ETH 3 - 100BASE-TX
USB	1	USB 2.0
		USB 2.0 OTG (optional)

In- / Outputs

Type	Quantity	Possible configuration
Multifunctional inputs (software-configurable)	8	Analog voltage input (0 … 36 V)
		Current input (0 … 24 mA)
		Digital input
Digital outputs	3	High-side switch, max. 300 mA

TECHNICAL DRAWING

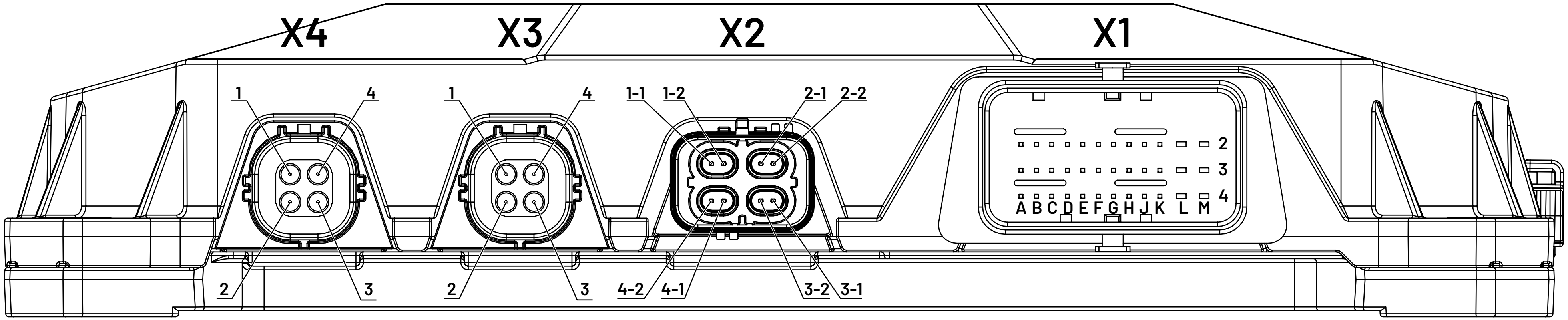


CYBERSECURITY FEATURES

Security capabilities

Category	Description	Relevant standards / conformity
Secure Subsystem	Integrated Secure Enclave as hardware Root-of-Trust, isolated security subsystem for cryptography, key management, and attestation	IEC 62443-4-2, ISO/SAE 21434, CRA Art. 10
Secure Boot	Hardware-based chain-of-trust from ROM boot to OS, signed images, eFUSE configuration, anti-rollback mechanism	ETSI EN 303 645 §5.2 / RED-DA Art. 3(3)(d)
Hardware Cryptography	AES, SHA, RSA, ECC accelerators, secure random number generator	FIPS 140-3 (supported with SE050), IEC 62443-4-2
Secure Key Storage	On-chip key storage within EdgeLock Enclave	Common Criteria EAL6+ (SE050), CRA Art. 10(2)
Secure Debug / JTAG	Authenticated or locked debug access, eFUSE locking	ETSI EN 303 645 §5.5
Secure OTA / Update Mechanism	Firmware update signature verification, rollback protection, staged rollout recommended	CRA Art. 10(5), RED-DA Art. 3(3)(e)
Runtime Attestation / Integrity Check	Attestation API via EdgeLock, proof of system integrity during runtime	IEC 62443-4-2 §7.8
SBOM (Bill of Materials)	Available for the complete system	CRA Art. 10(2) & (5)
Vulnerability Disclosure / PSIRT	See homepage: https://www.stw-mobile-machines.com/en/psirt/	ETSI EN 303 645 §5.1 / CRA Art. 11

PIN ASSIGMENT



Pin Assigment RF Connector X4 (white)

Pin	Signal
1	EB_B
2	EB_A
3	V2X_A
4	V2X_B

Pin Assigment RF Connector X3 (black)

Pin	Signal
1	5G-MAIN
2	GNSS
3	WIFI/BT
4	5G-DRX

Pin Assigment HF Connector X2

Pin	Option A Signal	Description	Option B Signal	Description
1-1	TRXP_4	100/1000Base-T1	RXP	100Base-TX
1-2	TRXN_4	100/1000Base-T1	RXN	100Base-TX
2-1	TRXP_3	100/1000Base-T1	TXP	100Base-TX
2-2	TRXN_3	100/1000Base-T1	TXN	100Base-TX
3-1	TRXP_2	100/1000Base-T1	TRXP_2	100/1000Base-T1
3-2	TRXN_2	100/1000Base-T1	TRXN_2	100/1000Base-T1
4-1	TRXP_1	100/1000Base-T1	TRXP_1	100/1000Base-T1
4-2	TRXN_1	100/1000Base-T1	TRXN_1	100/1000Base-T1

PIN ASSIGMENT

Pin Assigment Main Connector X1

Pin	Signal	Main function	Second function
A2	CAN0_L	CAN0 Low	
B2	CAN0_H	CAN0 High	
C2	CAN2_L	CAN2 Low	
D2	CAN2_H	CAN2 High	
E2	RX1	RS232_1 RxD	
F2	TX1	RS232_1 TxD	
G2	MIN1	Multifunction Input 1	
H2	MIN2	Multifunction Input 2	
J2	MIN3	Multifunction Input 3	
K2	MIN4_WD	Multifunction Input 4	Wheel Direction Input
L2	DOUT1	Digital Output 1	
M2	DOUT2	Digital Output 2	
A3	CAN1_L	CAN1 Low	
B3	CAN1_H	CAN1 High	
C3	CAN3_L	CAN3 Low	
D3	CAN3_H	CAN3 High	
E3	RX2	RS232_2 RxD	RS485 B
F3	TX2	RS232_2 TxD	RS485 A
G3	MIN5_WT	Multifunction Input 5	Wheel Tick Input
H3	MIN6_WU	Multifunction Input 6	Wakeup Input
J3	MIN7_Roff	Multifunction Input 7	Radio-Off Input
K3	MIN8_1PPS	Multifunction Input 8	1 pulse per sec Input
L3	KL15	Ignition Input	
M3	DOUT3_1PPS	Digital Output 3	1 pulse per sec Output

Pin Assigment Main Connector X1

Pin	Signal	Main function	Second function
A4	T1S1_N	10BASE-T1S TRX- (In/Out)	
B4	T1S1_P	10BASE-T1S TRX+ (In/Out)	
C4	T1S2_N	10BASE-T1S TRX- (Out/In)	
D4	T1S2_P	10BASE-T1S TRX+ (Out/In)	
E4	USB_DN	USB D-	
F4	USB_DP	USB D+	
G4	USB_ID	USB ID	
H4	USB_V	USB VBUS	
J4	GND	GND	
K4	GND	GND	
L4	GND	GND	
M4	+UB	Power supply input	

PLANNED QUALIFICATION

Regulatory body/standard	Description	Remarks
CE conformity CE	According document can be found in the User Manual	
KBA (Kraftfahrt-Bundesamt) E1	Compliant with the requirements of UN ECE Regulation No. 10	Suitable for all vehicles with 12 V or 24 V electrical systems (negative ground).
ISO 16750	Road Vehicles – Environmental conditions and electrical testing for electrical and electronic equipment	CODE ISO 16750-C/E-Z(4.2.2)-C-H-D-Z(IP6k6/IP6k7/IP6k9k)
DIN EN 13309	Construction machinery - Electromagnetic compatibility of machines with internal power supply	
ISO 13766	Earth-moving machinery - Electromagnetic compatibility	
DIN EN ISO 14982	Agricultural and forestry machines - Electromagnetic compatibility	Compliance with this standard is only achieved in combination with an external load-dump module. The max. clamping voltage must not exceed 55 V!

PLANNED QUALIFICATION

Environmental qualification

Standard	Test description	Parameter
ISO 20653	IP protection class	IP6Kx, IPx7
DIN EN 60068-2-6	Vibration (sinusoidal)	10 Hz to 2 kHz, 1 oct./min., 5 g, 10 cycles, bidirectional
DIN EN 60068-2-27	Shock	50 g, 11 ms, half sinus, 3 shocks/axis
DIN EN 60068-2-27	Bump	30 g, 6 ms, half sinus, 1000 shocks/axis
ISO 16750-4	Tests at constant temperature - high temperature - storage	48 hours at 85 °C
ISO 16750-4	Tests at constant temperature - low temperature - storage	24 hours at -40 °C

Countries with planed certification

Albania	Croatia	Iceland	Malaysia	Slovenia
Andorra	Cyprus	India	Malta	South Africa
Argentina	Czech Republic	Indonesia	Mexico	South Korea
Australia	Denmark	Ireland	Netherlands	Spain
Austria	Estonia	Isle of Man	New Zealand	Sweden
Belgium	Faroe Islands	Israel	Norway	Switzerland
Bosnia and Herzegovina	Finland	Italy	Peru	Taiwan
Brazil	France	Japan	Philippines	Thailand
Bulgaria	French Guiana	Kosovo	Poland	Turkey
Canada	Germany	Latvia	Portugal	United Arab Emirates
Canary Islands	Gibraltar	Liechtenstein	Romania	United Kingdom
Chile	Greece	Lithuania	Saudi Arabia	USA (depending on mobile service provider)
Colombia	Greenland	Luxembourg	Singapore	Vietnam
Costa Rica	Hungary	Madeira	Slovakia	