GWC 531-TF

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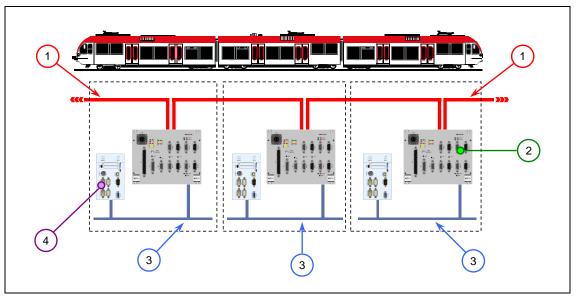
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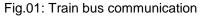
1. WTB-CAN-Gateway GWC 531-TF

1.1 Introduction

1.1.1 Train Bus Communication System

Train bus communication is used for inner-train communication. The train consists of individual cars or a unit comprising several cars permanently coupled together.





Legend:

	Device	Function
1:	Train bus	Inter-car / inter-unit communication bus. Permits communication within a train unit.
2:	Train bus coupler	Connects the vehicle bus with the train bus (gateway). It is responsible for the train setup and provides the communication channel on the train bus.
3:	Vehicle bus	Communication bus within a car / unit.
4:	Vehicle control unit (VCU)	The VCU is responsible for control within a car / unit. It functions as the vehicle bus master and controls the train bus coupler. One of the vehicle control units also takes over the function of the train bus master as soon as the train bus setup is initiated.

1.1.2 Train Bus Coupler

The various carriages or units must be coupled together in order to guarantee communication between the train bus (WTB) and vehicle bus (CAN).

There is a train bus coupler in each car (each unit) which permits train bus communication and provides a connection to the vehicle bus in the car/unit.

The WTB-CAN-Gateway GWC 531-TF takes charge of the coupling between trainbus (WTB) and vehicle bus (CAN).

1.2 Directives

1.2.1 Standards and Regulations

Normative Documents to be Applied:

- [N1] IEC 61375-1 Train Communication Network
- [N2] UIC556 (12th Version) Transmission d'Information dans le Train
- (Bus de Train)
- [N3] EN 50155 Railway Application Electronic Equipment used on Rolling Stock
- [N4] CEI 70-381 Designation of protection degrees
- [N5] UNI EN ISO 9001 Quality systems Model for quality assurance in design, development, production, installation and servicing
- [N6] IEC297 Dimensions of mechanical structure of the 482.6 mm series, Part 1-4
- [N7] Chapter "Installation, Startup, and Operation", <u>subchapter CAN Bus</u> <u>Shielding Concept</u>

1.2.2 Glossary and Abbreviations

Technical Terms for WTB-Gateways:

Device:	Is a unit connected to one or more buses (i.e. to the Multifunction Vehicle Bus or to the Wire Train Bus).
Gateway:	Is a connection between two non-homogeneous buses, which requires data analysis and protocol conversion.
Node:	WTB device which can act as gateway between WTB and MVB

Abbreviations Concerning WTB-Gateways:

	5 ,
ASIC	Application Specific Integrated Circuit
BA	Bus Address
BAT	Battery
BATI	Battery Filtered Input
BATN	Battery Negative (0 Vdc)
BATP	Battery Positive (+24 Vdc nominal)
BD	Bus Data
BDM	Background Debugging Mode
CRES	(Event Status Manager $ ightarrow$) Controller Reset Signal
DCI	Display Control Interface
EIRQ	EISA interrupt request
EISA	Extended Industry Standard Architecture
ESM	Exception- and SleepMode-Handler
EXP	Expansion
FLT	Fault
FPGA	Field Programmable Gate Array
FRT	Fritting Unit
GPIO	General Purpose Input/Output

Abbreviatio	ons Concerning WTB-Gateways:
GW	Gateway
IRQ	Interrupt Request
ISO	International Organization for Standardization
JMP	Jumper
JTAG	Joint Test Action Group
LP	Low Power
LRP	Power supply board
LRU	Line Replaceable Unit
MAU	Medium Attachment Unit
NVSRAM	Non-volatile SRAM
OEM	Original Equipment Manufacturer
OPTO	Optocoupler
PB	Printed Board
PE	Power Enable (Signal)
PWR	Power
RAM	Random Access Memory
RESETH	(Gateway CPU $ ightarrow$) Hardware Reset Signal
SCR	Silicon-Controlled Rectifier
SDRAM	Synchronous Dynamic RAM
SENSE	Voltage sense signal for battery voltage monitoring
SMC	Surface Mounted Connector
SPI	Serial Peripheral Interface bus
SRAM	Static RAM
SRV	Service
TCN	Train Communication Network
UIC	International Union of Railways
VCC	Voltage of the common collector
VNN	Negative voltage
VOFF	Microprocessor Voltage Off Signal Command
VU	Voting Unit
WRES	WTB Reset-Signal
WTB	Wire Train Bus

Abbreviations Concerning WTB-CAN-Gateway GWC 531-TF

CAN	Controller Area Network
CBB	CAN Base Board

1.2.3 Scope

This is the user and maintenance manual for integrators, programmers and maintenance personnel of systems based on the GWC 531-TF-Gateway system.

It contains general information, electrical safety instructions, assembly and installation instructions, specifications and maintenance instructions concerning the GWC 531-TF system.

1.2.4 How to Use this Manual

This manual should be read carefully and in full.

The user must employ the GWC 531-TF device only as specified in this manual.

Selectron Systems Ltd. cannot be held responsible for damages to any person or property, or for any resulting financial loss or cost caused by inappropriate product use or failure to observe this manual.

1.2.5 Intended Audience

This manual is written for the original equipment manufacturer (OEM) who plans to build TCN gateway systems based on the GWC 531-TF system. The installation, configuration, commissioning and maintenance of the GWC 531-TF are only allowed to be performed by a qualified and trained person.



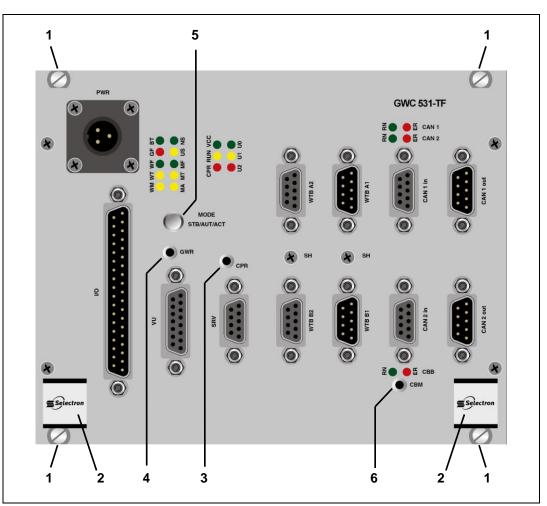
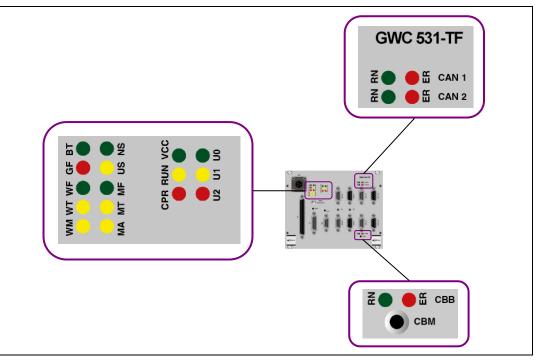


Fig.02: Front view of the GWC 531-TF

Legend:

- 1: Screws Attachment of the front panel to horizontal rail
- 2: Handles
- 3: CPR Can be used to issue a manual reset to the CPU
- 4: GWR Can be used to issue a manual reset to the GWC 531-TF
- 5: MODE Toggle switch: → see <u>1.6 Gateway Redundancy</u>", pg.10 for a detailed description
 6: CBM CAN Base Board Mode: When pressed during power on, the application on the CBB will not
- 6: CBM When pressed during power on, the application on the CBB will not start up.

1.4 LED Display





Legend:

Name	Color	Function
WM	Yellow	on when the GWC 531-TF is the master of WTB
WT	Yellow	on when there is traffic on the WTB line
WF	Green	on when the WTB line is faulty
GF	Red	on when the GWC 531-TF is fault
BT	😑 Green	on when the train battery is charging
MA	Yellow	Reserved
MT	Yellow	Reserved
MF	😑 Green	reserved
US	O Yellow	flashing $\left\{ \begin{array}{c} long \\ short \end{array} \right\}$ when the GWC 531-TF is $\left\{ \begin{array}{c} active \\ in \ standby \ mode \end{array} \right\}$
NS	😑 Green	flashing when the GWM 531-TF/xxx is in sleep mode
CPR	Red	on when the CPU is resetting
RUN	Yellow	on when the CPU is running
VCC	😑 Green	Supply voltage monitoring OK
U2	Red	on when the WTB line(s) is(are) disturbed
U1	Yellow	on when the node is an endpoint
U0	😑 Green	on when the fritting signal is present on WTB
CAN1 RN	Green	on when status of CAN bus 1 is OK flashing when CAN communication 'Warning Limit' reached
CAN1 ER	Red	on when status of CAN bus 1 is ERROR

Name	Color	Function
CAN2 RN	e Green	on when status of CAN bus 2 is OK flashing when CAN communication 'Warning Limit' reached
CAN2 ER	Red	on when status of CAN bus 2 is ERROR
CBB RN	Green	on when CBB is running
CBB ER	Red	permanently on if a fatal error persists flashing if an application error persists

1.5 Dimensions

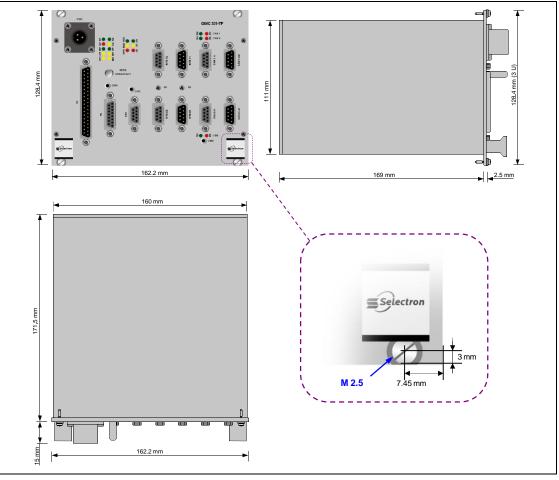


Fig.04: Mechanical dimensions of the GWC 531-TF

- U: A rack unit or U (less commonly, RU) is a unit of measure used to describe the height of electrical equipment. One rack unit is 1.75 inches (44.45 mm) high.
- HP: The horizontal pitch is a unit of measure used to describe the width of electrical equipment. One HP corresponds to 1/5 inch (5.08 mm).

1.6 Gateway Redundancy

The GWC 531-TF gateway is able to run as cold and warm standby using a couple of GWC 531-TF hereinafter called redundant gateway or redundant node.

The MODE switch present on the front panel of the GWC 531-TF declares the function mode:

- 1. AUT (automatic): the switchover is performed automatically by the VU
- 2. STB (standby): the unit is forced to standby
- 3. ACT (active): the unit is forced to active

1.6.1 Single Mode (No Redundancy)

In case of single mode (no redundancy), the AUT function is disabled. If MODE switch is forced to AUT then the gateway will fall into fault status.

1.6.2 Cold Standby Redundancy

To implement the cold standby, one unit shall be set to standby and the other to active. In case of failure, an operator shall put the faulty unit to standby and the backup unit to active using the switches.

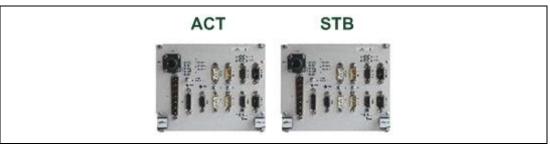


Fig.05: Cold Standby of GWC 531-TF

1.6.3 Warm Standby Redundancy

To implement the automatic switchover, both switches shall be put in automatic or active. Additionally the two devices must be connected by the exchange cable.

Both MODE Switches Put to AUT

Redundancy in case of an internal hardware- or software problem.

In case of a <u>power supply failure</u> both devices are deactivated and go to failure mode. Then the inactive device must be set manually to ACT to reenable the WTB communication. A new "train inauguration" has to be done.

MODE Switches Put to Automatic:

Redundancy at:

- internal hardware problems
- internal software problems

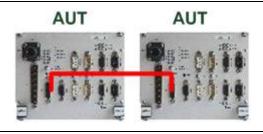


Fig.06: Warm Standby, MODE switches put in AUT

Both MODE Switches Put to ACT

Redundancy in case of an internal hardware- or software problem.

In case of a <u>power supply failure</u> the inactive device automatically takes over (no "train inauguration" needed).

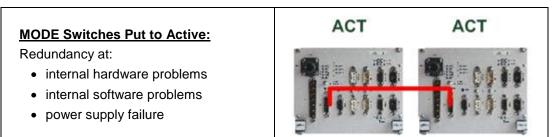


Fig.07: Warm Standby, MODE switches put in ACT

If the active device fails, the voting unit (VU) switches the faulty unit to standby, and the backup unit to active. This automatic switchover works in both directions as long as one device has a fault and the other one does not. In case the backup is faulty (double fault), the VU also switches the backup unit to standby (see also <u>1.8.5.3 Pin-Out of the VU Connector</u>, pg.26). Perform a manual replacement to recover from the double fault.

The persistent system is made of a couple of GWC 531-TF connected by the exchange cable (see $\underline{Fig.08}$). The exchange cable is 30 cm long.

The power supply of the two units shall be connected together externally. To reduce the impact of the single battery in the coach hosting the persistent system, a wired "or" (with diodes) can be used to join more than one battery together.

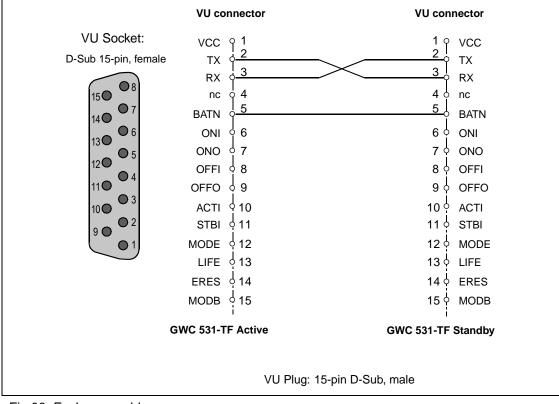


Fig.08: Exchange cable

1.7 Functional Specifications

This section presents the functionality of the GWC 531-TF.

1.7.1 Basic Circuit Diagram

The GWC 531-TF system is composed of five main building blocks.

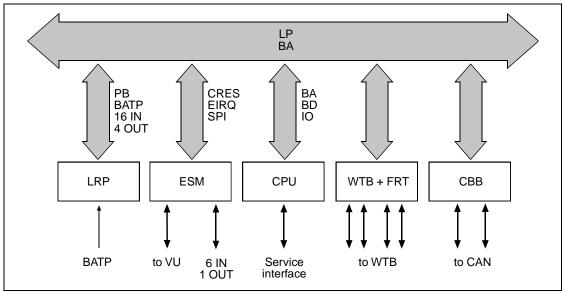


Fig.09: Block diagram of the GWC 531-TF device

Legend:

J	
BA	Bus address
BD	Bus data
BATP	Battery positive (+24°Vdc nominal)
CAN	Controller Area Network
CBB	CAN Base Board
CPU	Central Processing Unit
CRES	(Event Status Manager) Controller Reset Signal
EIRQ	EISA Interrupt request
ESM	Exception- and Sleep Mode-Handler
FRT	Fritting Unit
LP	Low Power
LRP	Power supply board
PB	Printed Board
SPI	Serial Peripheral Interface bus
VU	Voting Unit
WTB	Wire Train Bus

1.7.2 CPU Board

The CPU board manages the interactions with the communication boards and handles all the jobs concerning the application level of the train communication network (TCN).

The following figure represents the block diagram of the CPU board.

- > The FLASH memory contains the firmware of the GWC 531-TF.
- The NVSRAM is used to hold the configuration database of the GWC 531-TF.

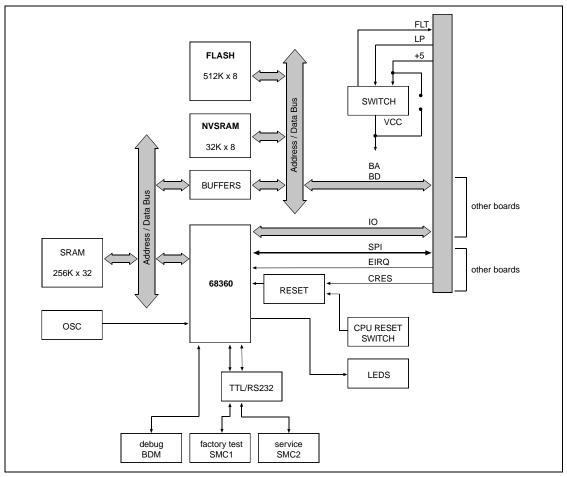


Fig.10: Block diagram of the CPU board

Legend:

BA	Battery Positive (+24 Vdc nominal)
BD	Bus Data
BDM	Background Debugging Mode
CRES	(Event Status Manager) controller Reset Signal
EIRQ	EISA Interrupt request
FLT	Fault
LP	Low Power
SMC	Surface Mounted Connector
(NV)SRAM	(non-volatile) static random access memory
SPI	Serial Peripheral Interface bus
VCC	Voltage of the Common Collector

1.7.3 Gateway Functionality

The two communication boards of the GWC 531-TF (the MVB board and the WTB board) interface the device with the correspondent train bus, i.e. the train bus WTB and the vehicle bus MVB.

1.7.3.1 CAN Communication Board (CBB)

The CAN communication board handles communication with the CAN bus.

It is composed of a master board, called CBB, on which the TriCore TC1130 device manages communication on the CAN bus.

Data exchange between WTB data and CAN data is made through a shared memory unit installed on CBB.

CBB also provides a physical layer of the CAN bus. The block diagram of the CBB communication board is shown in the figure below.

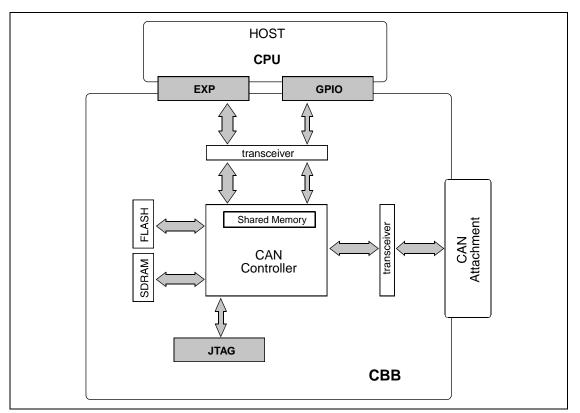


Fig.11: Block diagram of the CAN communication board

Legend:	
CAN	Controller Area Network
CBB	CAN bus board
EXP	Expansion
FLASH	Flash memory
GPIO	General Purpose Input/Output
JTAG	Joint Test Action Group
SDRAM	Synchronous dynamic random access memory

1.7.3.2 WTB Communication Board and Fritting Management Unit

The WTB board provides the interface to the WTB train bus.

The block diagram of the WTB communication board is shown in the following figure.

The FWC is an ASIC which handles communication with the WTB. It drives the physical layer transmitters and receivers present on the board and manages the redundancy switchover. The blocks labeled "WTB Protective circuit" signal to the FWC the presence of a short circuit on a direction of the WTB bus, so it can shut down the corresponding transmitter. On-board, there are the attachment relays and the relays to set the node to an intermediate setting or end node setting as described in the

IEC TC9 WG22 TCN 1375 - 9/413/CDV Section 4 - Wire Train Bus document (see [N1], pg.4).

The WTB attachment hosts the fritting unit with the purpose of issuing the fritting voltage to the communication cables. The fritting pulse is 48 V (+20%, -10%) and does not exceed 80 mA. In most cases, this pulse is sufficient to clean oxidation off the contacts.

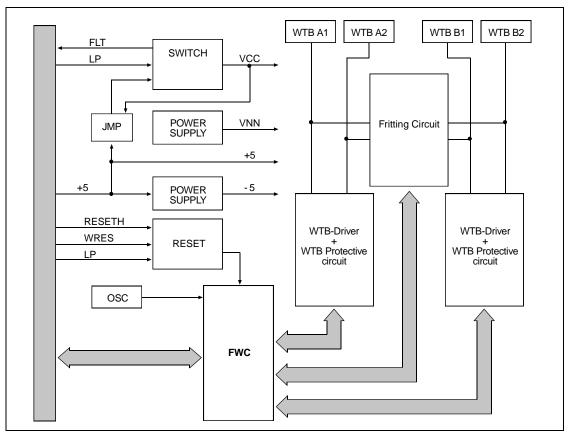


Fig.12: Block diagram of the WTB communication board

Legend:	
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ASIC	Application Specific Integrated Circuit
FWC	An ASIC that handles communication with the WTB
RESETH	Reset hard
VCC	Voltage of the Common Collector
VNN	Negative voltage
WRES	WTB Reset signal
WTB	Wire Train Bus

1.7.4 Shielding Concept

This section describes the MVB channel shielding and the WTB channel shielding options.

Please also refer to [N1] (pg.4), <u>section 4.2.2.5 "Shielding concept for the WTB"</u>. See also [N7] (pg.4).

1.7.4.1 CAN Shielding

The CAN connectors present on the GWC 531-TF are directly connected to the housing. The shielding of the CAN is shown in this following figure.

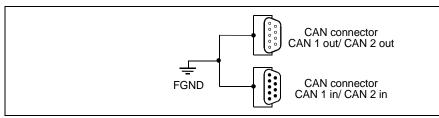


Fig.13: CAN connector shielding

Legend:

CAN	Controller Area Network
FGND	Functional ground

1.7.4.2 WTB Shielding

The connectors present on the GWC 531-TF are conductive. They assure the shield continuity between the two directions of a communication line.

The shield can be hard connected to the housing of the GWC 531-TF putting a screw into the SH hole. In the following figure the two shielding options (with and without screw) for the WTB channels are shown.

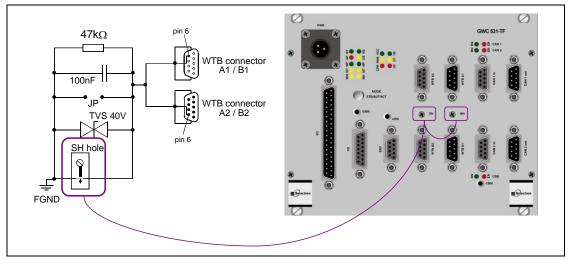


Fig.14: WTB connector shielding

1.7.5 Power Supply Board

The power supply board (LRP) supplies the voltages required by the other components of the system. It provides a "clean" power supply to the electronic devices of the gateway, featuring:

- Electrical isolation
- Common mode input filtering
- Differential mode input filtering
- Protection against input polarity reversal
- Overvoltage lockout circuit
- Undervoltage lockout circuit
- Output current limitation
- Protection against output overvoltage
- Thermal shutdown

The block diagram of the power supply board is shown in the following figure.

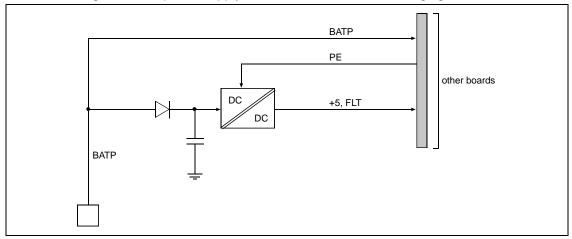


Fig.15: Block diagram of the power supply board

Legend:

BATP	Battery Positive (+24 Vdc nominal)
FLT	Fault
PE	Power Enable (Signal)

1.7.6 Exception Handler, Sleep Mode Handler, and General Purpose I/O Board

The following figure shows the block diagram of the ESM board in charge of handling exceptions to normal operation, entering and exiting sleep mode status and the general purpose I/O.

A microcomputer is in charge of the exception supervision and handling. Specifically, this unit performs

- monitoring of the vehicle battery voltage (BATP), so it is able to shut down the node according to [N1] (pg.4).
- watchdog functions, so it will shut down the node in case of a persistent failure when a single node is configured or will switch over the standby node when a redundant node is configured.

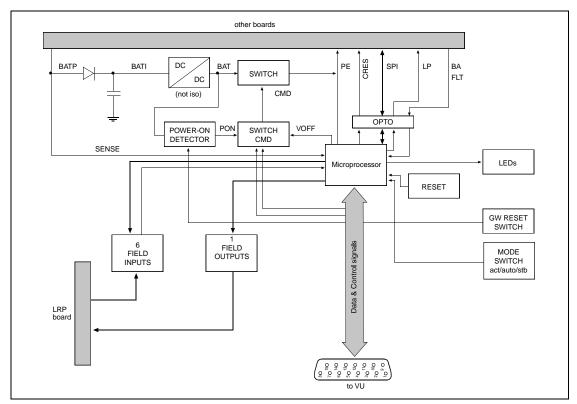


Fig.16: Block diagram of the ESM board

BA	Bus address
BAT	Battery
BATI	Battery Filtered Input
BATP	Battery Positive (+24°Vdc nominal)
CMD	Command
CRES	(Event Status Manager) Controller Reset Signal
FLT	Fault
GW	Gateway
LP	Low Power
LPR	Power supply board

OPTO	Optocouple	r
PE	Power Enab	ole (Signal
PON	Power ON	
SENSE	Voltage sen	se signal for battery voltage monitoring
SPI	Serial Perip	heral Interface bus
VOFF	Microproces	ssor voltage off signal command
VU	Voting Unit	
MODE swi	tch	
act	Active	(the unit is forced to active)
auto	Automatic	(the switchover is performed automatically by the VU)

(the unit is forced to standby)

Standby

stb

1.8 Installation and Maintenance

1.8.1 Packing List

The package contains the following items:

- Das GWC 531-TF Gateway
- The product sheet describing installation, dimensions and connectors
- Mating connectors for the following connector mounted on the GWC 531-TF: power connector PWR *¹

*) see Fig.17: Composition of a wired GWC 531-TF system, pg.22

On request:

- Mating connectors for the following connectors mounted on the GWC 531-TF:
 - 1. CAN connectors CAN 1 and CAN 2 (see 1.8.5.5 Pin-Out of the CAN Connectors, pg.28)
 - 2. WTB connectors WTB A1, WTB A2, WTB B1 and WTB B2 (see <u>1.8.5.6 Pin-Out of the WTB Connectors</u>, pg.29)
- Declaration of conformity

1.8.2 Assembly Instructions

The product is ready to use.

1.8.3 Required Tools

This section lists hardware and software tools required to install and configure the GWC 531-TF systems.

1.8.3.1 Hardware Tools

The following tools are necessary for the GWC 531-TF to work:

- 1. Screwdriver
- 2. Personal computer running under Microsoft Windows operating system, hereinafter called PC, at least with the following characteristics:
 - Serial RS-232 port required for software download onto the GWC 531-TF
 - Approximately 30 MB free disk space
- 3. An RS-232 D-sub 9-pin male-female cable (see 1.8.6 Accessories, pg.31)

1.8.4 Hardware Installation Instructions

The GWC 531-TF is equipped with four screws on the front panel, which can be used to fasten it to a communication rack according to the IEC297 standard; screws are labeled "1" in Fig.02: Front view of the GWC 531-TF, pg.7.

With the power supply turned OFF

- Fasten the GWC 531-TF into the destination rack
- Connect the power supply cable to the PWR connector *)
- Connect the WTB cables to the WTB communication connectors *)
- Connect the MVB cables to the MVB communication connectors *)
- Connect the male connector of the RS-232 cable to the SRV connector *¹ and the female connector to the RS-232 serial interface on the PC. This connection is intended as temporary and allows you to download the configuration database for the GWC 531-TF. Once configured, please remove this cable.
- Connect the I/O cable to the I/O connector *)
- If you want to make a redundant node (see <u>1.6 Gateway Redundancy</u>, pg.10), connect the exchange cable (see <u>Fig.08</u>, pg.12) to the VU connector (see <u>Fig.02</u>: <u>Front view of the GWC 531-TF</u>, pg.7).

*) see following figure:

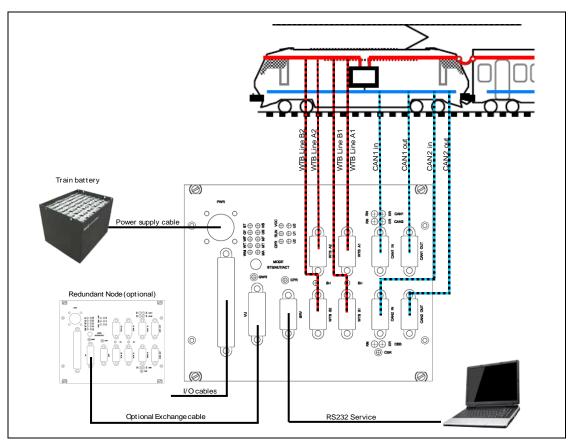


Fig.17: Composition of a wired GWC 531-TF system

1.8.5 Connectors Pin-Out

This paragraph describes the pin-outs of the GWC 531-TF.

1.8.5.1 Pin-Out of the PWR Connector

The PWR connector is used to supply the power to the GWC 531-TF and is a 3-pin male connector (CAA 501-T, art.no. 44170011). The corresponding female 3-pin mating connector consists of a telescopic bushing with a strain relief and a straight plug with an internal cap. The cable must be shielded and the cross section of the three wires of the cable must be 1 mm² each.

Pin	Name	Dir	Function
А	FGND	-	Frame ground (internally connected to the enclosure)
В	BATP	I -	Battery positive: +24 Vdc nominal
С	BATN	I	Battery negative: 0 Vdc nominal

- not applicable
- I: input signal

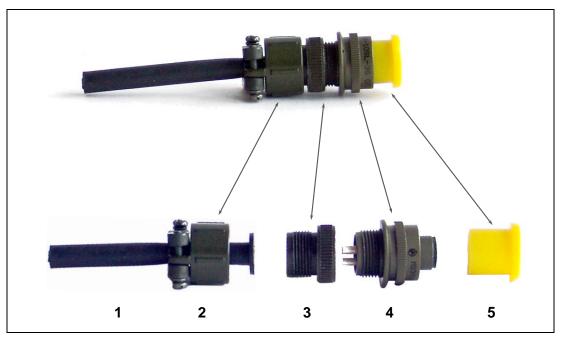


Fig.18: CAA 501-T: Supply connector Amphenol MIL, 3 pin

Legend:

 Telescopic bushing Strain relief Straight plug Internal cap 	Part	Function
3+4 Straight plug	1	Telescopic bushing
0 1 0	2	Strain relief
5 Internal cap	3+4	Straight plug
	5	Internal cap

1.8.5.2 Pin-Out of the I/O Connector

The I/O connector is a D-sub 37-pin male connector. The screw lock is a UNC 4-40 type. The pin assignment of the I/O connection is explained in the following table.



The cable must be shielded and the cross section of the wires must be 0.25 \mbox{mm}^2 .

9PIN4Inputbattery charger, the input must be the OR of all 'battery charger is running' signals.10NIN4Input+ 24 V battery11PIN5InputInput 5 – Light on. Set this input to active when the train lights are switched on. (UIC cable #10 and #12).	Pin	Name	Direction	Description
3PIN1InputInput 1 – Wake-up command. When the input is activated the node is awakened from its sleep mode (the input is equivalent to the 'node_awake' signal according to TCN standard).4NIN1Input+24 V battery5reserved6reserved7PIN3InputInput 3 – Driver key #1. The command associated with the key of cab #1 for the definition of traction master. Usually the input is activated when the key is turned on.8NIN3Input+24 V battery9PIN4InputInput 4 – Battery charger. Set this input active when the battery charger is running. If the vehicle has more than one battery charger is running' signals.10NIN4Input+ 24 V battery11PIN5InputInput 5 – Light on. Set this input to active when the train lights are switched on. (UIC cable #10 and #12).	1	reserved	_	-
3PIN1Inputthe node is awakened from its sleep mode (the input is equivalent to the 'node_awake' signal according to TCN standard).4NIN1Input+24 V battery5reserved6reserved7PIN3InputInput 3 - Driver key #1. The command associated with the key of cab #1 for the definition of traction master. Usually the input is activated when the key is turned on.8NIN3Input+24 V battery9PIN4InputHout 4 - Battery charger. Set this input active when the battery charger is running. If the vehicle has more than one battery charger is running' signals.10NIN4Input+ 24 V battery11PIN5InputInput 5 - Light on. Set this input to active when the train lights are switched on. (UIC cable #10 and #12).	2	reserved	_	-
5 reserved - - 6 reserved - - 7 PIN3 Input Input 3 – Driver key #1. The command associated with the key of cab #1 for the definition of traction master. Usually the input is activated when the key is turned on. 8 NIN3 Input +24 V battery 9 PIN4 Input Input 4 – Battery charger. Set this input active when the battery charger is running. If the vehicle has more than one battery charger is running' signals. 10 NIN4 Input + 24 V battery 11 PIN5 Input Input 5 – Light on. Set this input to active when the train lights are switched on. (UIC cable #10 and #12).	3	PIN1	Input	the node is awakened from its sleep mode (the input is equivalent to the 'node_awake' signal according to TCN
6reserved-7PIN3InputInput 3 – Driver key #1. The command associated with the key of cab #1 for the definition of traction master. Usually the input is activated when the key is turned on.8NIN3Input+24 V battery9PIN4InputInput 4 – Battery charger. Set this input active when the battery charger is running. If the vehicle has more than one battery charger is running' signals.10NIN4Input+ 24 V battery11PIN5InputInput 5 – Light on. Set this input to active when the train lights are switched on. (UIC cable #10 and #12).	4	NIN1	Input	+24 V battery
7PIN3InputInput 3 – Driver key #1. The command associated with the key of cab #1 for the definition of traction master. Usually the input is activated when the key is turned on.8NIN3Input+24 V battery9PIN4InputInput 4 – Battery charger. Set this input active when the battery charger is running. If the vehicle has more than one battery charger is running' signals.10NIN4Input+ 24 V battery11PIN5InputInput 5 – Light on. Set this input to active when the train lights are switched on. (UIC cable #10 and #12).	5	reserved	_	-
7PIN3Inputkey of cab #1 for the definition of traction master. Usually the input is activated when the key is turned on.8NIN3Input+24 V battery9PIN4InputInput 4 – Battery charger. Set this input active when the battery charger is running. If the vehicle has more than one battery charger, the input must be the OR of all 'battery charger is running' signals.10NIN4Input+ 24 V battery11PIN5InputInput 5 – Light on. Set this input to active when the train lights are switched on. (UIC cable #10 and #12).	6	reserved	-	-
9PIN4InputInput 4 – Battery charger. Set this input active when the battery charger is running. If the vehicle has more than one battery charger, the input must be the OR of all 'battery charger is running' signals.10NIN4Input+ 24 V battery11PIN5InputInput 5 – Light on. Set this input to active when the train lights are switched on. (UIC cable #10 and #12).	7	PIN3	Input	key of cab #1 for the definition of traction master. Usually
9PIN4Inputbattery charger is running. If the vehicle has more than one battery charger, the input must be the OR of all 'battery charger is running' signals.10NIN4Input+ 24 V battery11PIN5InputInput 5 – Light on. Set this input to active when the train lights are switched on. (UIC cable #10 and #12).	8	NIN3	Input	+24 V battery
11PIN5InputInput 5 – Light on. Set this input to active when the train lights are switched on. (UIC cable #10 and #12).	9	PIN4	Input	battery charger is running. If the vehicle has more than one battery charger, the input must be the OR of all 'battery
lights are switched on. (UIC cable #10 and #12).	10	NIN4	Input	+ 24 V battery
12 NINE Input 124 V battony	11	PIN5	Input	
	12	NIN5	Input	+24 V battery
13 reserved – -	13	reserved	-	-
14 reserved – -	14	reserved	-	-
15 reserved – -	15	reserved	-	-
16 reserved – -	16	reserved	-	-
17 reserved – -	17	reserved	-	-
18 reserved – -	18	reserved	-	-
19 reserved – -	19	reserved	-	-
20 reserved – -	20	reserved	-	-
21PIN10Input10 – Driver key #2. The command associated with the key of cab #2 for the definition of traction master. Usually the input is activated when the key is turned on.	21	PIN10	Input	
22 NIN10 Input +24 V battery	22	NIN10	Input	+24 V battery

Pin	Name	Direction	Description
23	PIN11	Input	Input 11 – Minimum voltage. Set this input to active when the voltage of the train battery is under the minimum threshold. If the input remains active for 5 minutes, the GWM 531-TF/xxx is switched off. The command is ORed with the function of monitoring of the power supply.
24	NIN11	Input	+24 V battery
25	reserved	-	-
26	reserved	-	-
27	reserved	_	-
28	reserved	-	-
29	reserved	_	-
30	reserved	_	-
32	reserved	_	-
32	reserved	-	-
33	OUT0	Output	Output 0 – Sleep command. The output voltage is active when the gateway is in sleep mode. In case of failure and during the start-up phase, the output is in high impedance.
34	OUT1	Output	reserved
35	reserved	_	-
36	reserved	-	-
37	reserved	_	-
nc:	not conne	cted	

- : not applicable



The digital inputs are active when the relevant pin is connected to +24 V battery. If the gateway is in sleep mode and one of the digital inputs #1, #3, #4, #5 or #10 is activated then the node is awakened.

1.8.5.3 Pin-Out of the VU Connector

The VU connector is a D-sub 15-pin female connector. The screw lock is a UNC 4-40 type. The corresponding mating connector is a 15-pin male connector.



The cable must be shielded and the cross section of the wires must be 0.25 \mbox{mm}^2 .

Pin	Name	Direction	Description
1	VCC	_	+5V
2	ТΧ	0	TX data
3	RX	I	RX data
4	_	_	-
5	BATN	_	Battery negative: 0 Vdc
6	ONI	I	ON request
7	ONO	0	ON command
8	OFFI	I	OFF request
9	OFFO	0	OFF command
10	ACTI	I	Gateway ACTIVE
11	STBI	I	Gateway STANDBY
12	MODE	0	Gateway mode
13	LIFE	0	Alive signal
14	ERES	I	External reset
15	MODB	I	MC68HC11 mode b pin
		-	

- : not applicable
- I: input signal
- O: output signal

The VU connector can be used:

- To connect two gateways together so as to make a persistent system
- To update the firmware of the ESM board

1.8.5.4 Pin-Out of the SRV Connector

The SRV connector is a serial RS-232 D-sub 9-pin female connector. The screw lock is a UNC 4-40 type.

The SRV interface is used to configure the GWM 531-TF/xxx using the PC, the IpTDC software and the VT100 terminal emulation software (HyperTerminal).

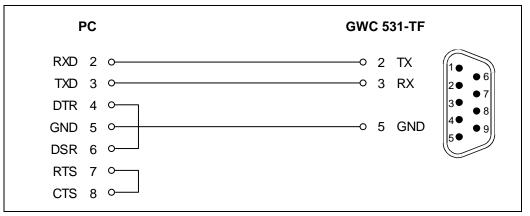


Fig.19: Pin-out of the SRV-Connector

The pin assignment of the SRV connection is explained in the following table.

Pin	Name	Direction	Description
1	nc	_	-
2	ТΧ	0	Transmit data
3	RX	I	Receive data
4	nc	_	-
5	GND	_	Ground
6	nc	_	-
7	nc	_	-
8	nc	_	-
9	nc	_	-
nc:	not conne	ected	

- : not applicable

I: input signal

O: output signal

1.8.5.5 Pin-Out of the CAN Connectors

The CAN connectors are four 9-pin male/female connectors. The connectors CBC 701-T or CBC 704-T can be used for this purpose (see <u>1.8.6.2 WTB and CAN Plugs</u>, pg.32). The screw lock is a UNC 4-40 type.

interface	CAN1 in / CAN2 in			CAN 1 out / CAN 2 out	
	CAN+		CAN+		
	Fi	g.20: Pins	s CAN 1/ 2 in		Fig.21: Pins CAN 1/ 2 out
Connector	D-sub 9-pin, female (UNC 4-40)		40)	D-sub 9-pin, male (UNC 4-40)	
Pin assignment	Pin 3 GND CA		CA	ta line – N reference point ta line +	



Use the bus terminating plug CBT 702-T (Article no. 44570102) for the CAN bus termination. More information is available about this in chapter "Accessories and Replacement Material".

1.8.5.6 Pin-Out of the WTB Connectors

The WTB connectors are two 9-pin male/female connectors.

Our CBC 703-T or CBC 705-T connectors can be used for this purpose (see <u>1.8.6.2 WTB and CAN Plugs</u>, pg.32). Pin 6 is connected internally with the D-sub connector and therefore does not have to be bridged to the D-sub housing externally (see following figure).

The screw lock is an M3 type.

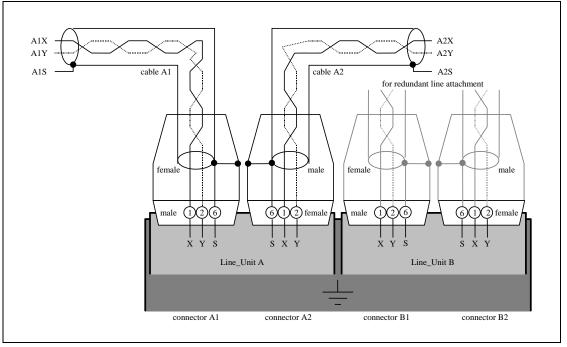


Fig.22: WTB connector pin-out

The following tables are an extract from [N1] (pg.4), where the pin-outs of the D-sub 9-pin connectors are

Pin	Name	Direction	Description
1	A1X	I/O	A1 positive wire
2	A1Y	I/O	A1 negative wire
3	nc	_	reserved
4	nc	-	reserved
5	nc	_	reserved
6	A1S	-	A1 shield ¹⁾
7	nc	_	reserved
8	nc	-	reserved
9	nc	-	reserved

¹⁾ Pin 6 is connected internally with the D-sub connector

Name	Direction	Description
A2X	I/O	A2 positive wire
A2Y	I/O	A2 negative wire
nc	-	reserved
nc	-	reserved
nc	-	reserved
A2S	-	A2 shield ¹⁾
nc	-	reserved
nc	-	reserved
nc	_	reserved
	A2X A2Y nc nc nc A2S nc nc	A2X I/O A2Y I/O nc - nc -

¹⁾ Pin 6 is connected internally with the D-sub connector

Pin	Name	Direction	Description
1	B1X	I/O	B1 positive wire
2	B1Y	I/O	B1 negative wire
3	nc	-	reserved
4	nc	-	reserved
5	nc	_	reserved
6	B1S	-	B1 shield ¹⁾
7	nc	_	reserved
8	nc	-	reserved
9	nc	-	reserved

¹⁾ Pin 6 is connected internally with the D-sub connector

Pin	Name	Direction	Description
1	B2X	I/O	B2 positive wire
2	B2Y	I/O	B2 negative wire
3	nc	-	reserved
4	nc	-	reserved
5	nc	-	reserved
6	B2S	-	B2 shield ¹⁾
7	nc	-	reserved
8	nc	-	reserved
9	nc	-	reserved

¹⁾ Pin 6 is connected internally with the D-sub connector

- nc not connected
- not applicable
- I/O input/output signal

1.8.6 Accessories

1.8.6.1 Supply Connector Amphenol MIL, 3 pin

Art.no. 44170011: CAA 501-T

The 3-pin Amphenol connector with solder contacts is used to replace the power supply connector of gateway GWC 531-TF.



Fig.23: Supply connector Amphenol MIL, 3 pin CAA 501-T

1.8.6.2 WTB and CAN Plugs

Selectron Systems Ltd. offers the following connectors for WTB:

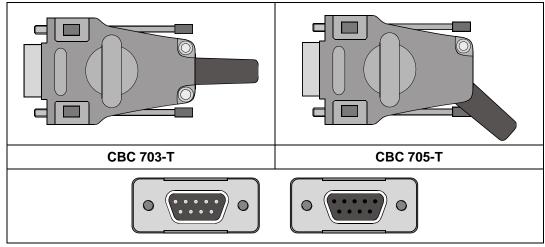


Fig.24: WTB plugs CBC 703-T and CBC 705-T

Selectron offers the following connectors for CAN:

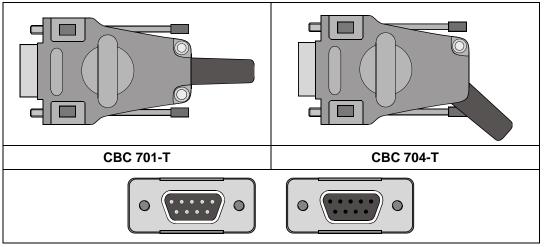


Fig.25: CAN plugs CBC 701-T and CBC 704-T

Legend:

Connector	for	Layout	Art.no.	Screw
CBC 703-T	WTB	Straight	44570110	M3
CBC 705-T	WTB	angled	44570112	M3
CBC 701-T	CAN	Straight	44570101	UNC 4-40
CBC 704-T	CAN	angled	44570111	UNC 4-40



A male connector as well as a corresponding female connector is included in the package.

1.8.6.3 WTB and CAN Cables

Depending on the application (CAN/WTB) there are different requirements for the cable specification. Selectron recommends the following cable types.

	CAN	WTB
Cable	DCA 701-T	DCA 703-T
Dimensions	1 x 2 x 0.5 mm ² (twisted pair) 1 x 0.5 mm ² , shielded	2 x 0.75 mm ² , shielded
Wave impedance f = 0.753.0 MHz	120 ±12 Ω	
Wave impedance f = 0.52.0 MHz		120 ±12 Ω
Attenuation f = 1 MHz	\leq 13.5 dB/km	\leq 10.0 dB/km
Attenuation f = 2 MHz	\leq 18.0 dB/km	\leq 14.0 dB/km
Transfer impedance f \leq 20 MHz	\leq 20 m Ω /m	
Transfer impedance f \leq 30 MHz		\leq 30 m Ω /m
Voltage rating	300 V	300 V
External diameter	6.8 mm	8.3 mm
Weight	6.6 kg/100 m	9.7 kg/100 m
Temperature range	-40 +90°C	-40 +100°C
Color	black	black
Length	On request [m]	On request [m]
Art.no.	44170055	44170070

CAN Cable Connector Pin-Out DCA 701-T:

Conductor pair CAN+ (red) and CAN- (blue) Conductor GND (black)

WTB Cable Connector Pin-Out DCA 703-T:

Conductor 1	X (red)
Conductor 2	Y (blue)



Make sure that the shield is fitted correctly. It must be folded back onto the cable sheath and be connected to the strain relief bracket **over a wide area**.

Fig.26: Cable DCA 703-T, connected to CBC 703-T plug



We recommend using a separate supply cable for the supply voltage (UC / 0V). However, always follow the instructions in this chapter as well.

1.8.7 Maintenance Instructions

This section explains the maintenance operations.

This product does not require special maintenance procedures for up to 10 years as of shipment from the manufacturing facility. Since the standard lifetime of railway equipment is 25 years on average, the user is advised to perform the maintenance activities described below. However GWC 531-TF employs state-of-the-art silicon storage devices that are guaranteed to retain the stored information, on average, up to 10 years.

1.8.7.1 Flash E²PROM

Every 7 years, the firmware should be reloaded from scratch into the internal flash E^2 PROM. It is customer's responsibility to maintain written documentation of the correct version of the firmware that will be downloaded.

1.8.7.2 NVSRAM

Every 7 years, the database should be reloaded from scratch into the internal NVSRAM. It is customer's responsibility to maintain written documentation of the correct version of the database that will be downloaded.

1.8.7.3 Repairing

The GWC 531-TF is a LRU (line replaceable unit). No repairs are allowed by the user. In case of a fault of the GWC 531-TF-Gateway contact Selectron Systems Ltd.

1.9 Technical Data

General Data GWC 531-TF

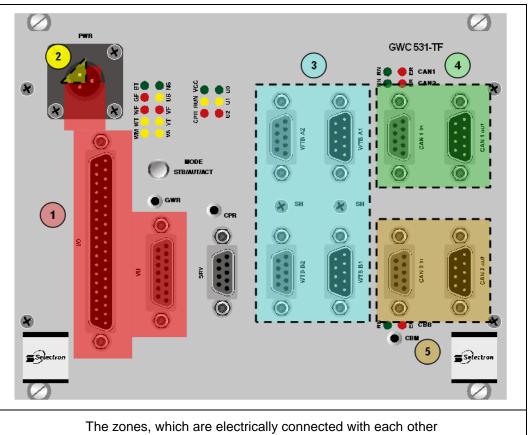
Electrical power supply			
Nominal supply voltage (US)	24 Vdc		
Limit values	16.836.0 Vdc		
Overvoltage lockout threshold	typ. 43 Vdc		
Undervoltage lockout threshold	typ. 14 Vdc		
Reverse polarity protection	Yes		
Dower concumption two	with Fritting: 14.4 W (600 mA)		
Power consumption typ.	w/o Fritting: 9.6 W (400 mA)		
Max. input inrush current	10 A ($t_{ein} = 0.4 \text{ ms}, t_{aus} = 1 \text{ ms}$)		
Thermal shutdown protection	Yes		
Index of protection	IP20		
Dimensions (W x H x D)	162.2 x 128.4 x 171.5 mm		
Weight	Approx.1850 g		
Article no.	44130017		

Ambient Conditions	
Ambient temperatures	
Operation	-40°C +70°C
Storage	-40°C +75°C
Relative humidity (not condensing)	
General	5% 90%
Operation	< 75 % average < 95 % for 30 consecutive days in one year
Storage	< 80 %
Stress	
Shock	compliant with EN 50155
Vibration	compliant with EN 50155
Resonance	compliant with EN 50155
Instrumentation	
CPU	Motorola MC68360 Quad Integrated Communication Controller
SRAM	1 MB
NSVRAM	32 kB
FLASH E ² PROM	512 kB
Communication	
CAN communication channels	CAN 1 in/out and CAN 2 in/out
CAN communication controller	MultiCAN controller of the TriCoreTM TC1796 CAN controller in accordance with CAN specification V2.0 B (active)
CAN communication handling	Data rate up to 1 Mbit/s CSMA/CA FIFO buffering
WTB communication channels	two redundant
WTB communication controller	FWC101
WTB communication handling	1 Mbit/s data rate Manchester biphase coding Signal quality checking Error detection
Maximum WTB distance between all gateways	850 m

Device-Specific Accessories

Article	Art.no.	Description
CAA 501-T	44170011	Supply connector Amphenol MIL, 3 pin
DCA 703-T	44170070	WTB data cable, shielded

1.10 Electrical Isolation



are indicated by the same color.

Fig.27: Electrical isolation of connections

Legend:

- 1: Train battery
- 2: Ground
- 3: WTB A and WTB B
- 4: CAN 1
- 5: CAN 2



For information regarding the EMC protection circuitry between power supply and earth connection, please refer to chapter "Installation, Startup, and Operation", subchapter <u>EMC Protection Circuitry Between Power Supply and Earth Connection</u>.