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1. Introduction

This hardware manual was developed to ease the use and implementation of a Moduline series embedded controller. There are a few related documents which are also described in this chapter. Information listed in this document is subjected to change. Therefor a changelog is added to this first chapter.

1.1. Related Documents

Alongside this hardware manual, there are two related documents to ease the use and implementation of a Moduline series embedded controller.

1.1.1. Moduline Embedded Controllers - Quick Start Guide

This document, as the name suggests, offers a quick start guide to power on the controller and connect to the controller.

1.1.2. Moduline Embedded Controllers - Software Manual

This document, as the name suggests, offers a comprehensive software manual with the most common procedures and instructions.

1.2. Changelog

This changelog keeps track of changes made to this document.

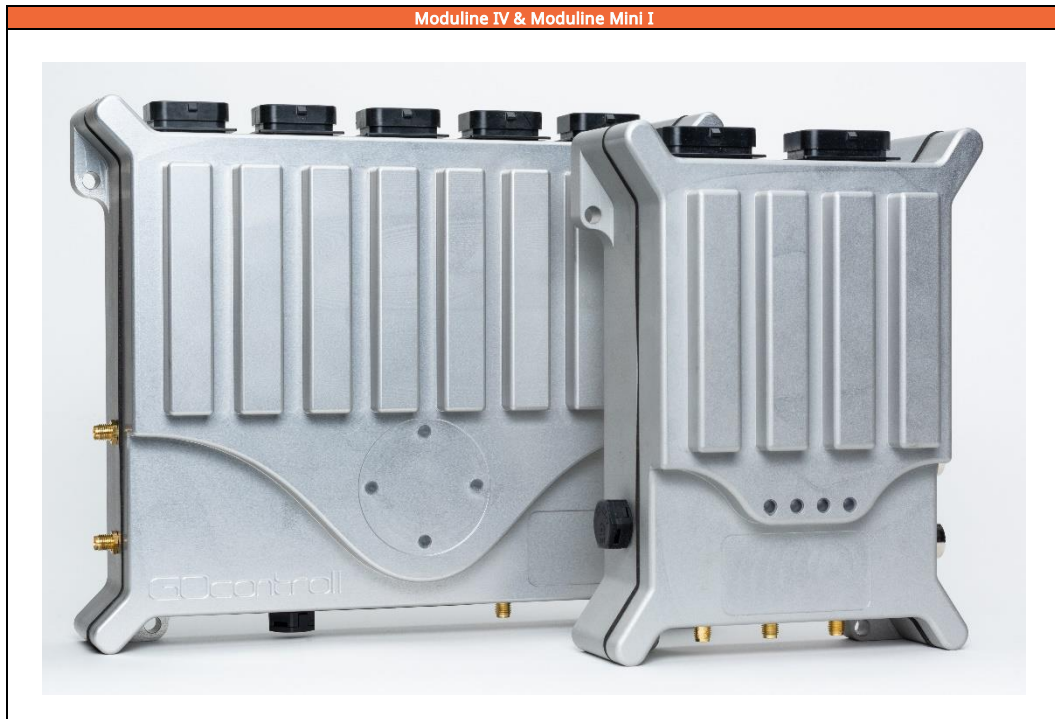
Version	Date	Changes
V1.00	05-12-2023	Initial version
V1.01	11-12-2023	Addition of IO connector hot-plugging warning

2. Enclosure

The robust enclosure offers IP67 protection and is equipped with a pressure equilibrium/vent plug to reduce the risk of condensation buildup from moisture in the air. It also protects the electronics inside from impacts and other influences the harsh environment of automotive applications may provide. The enclosure is CNC milled from billet EN-AW5083 Aluminum and anodized grey.

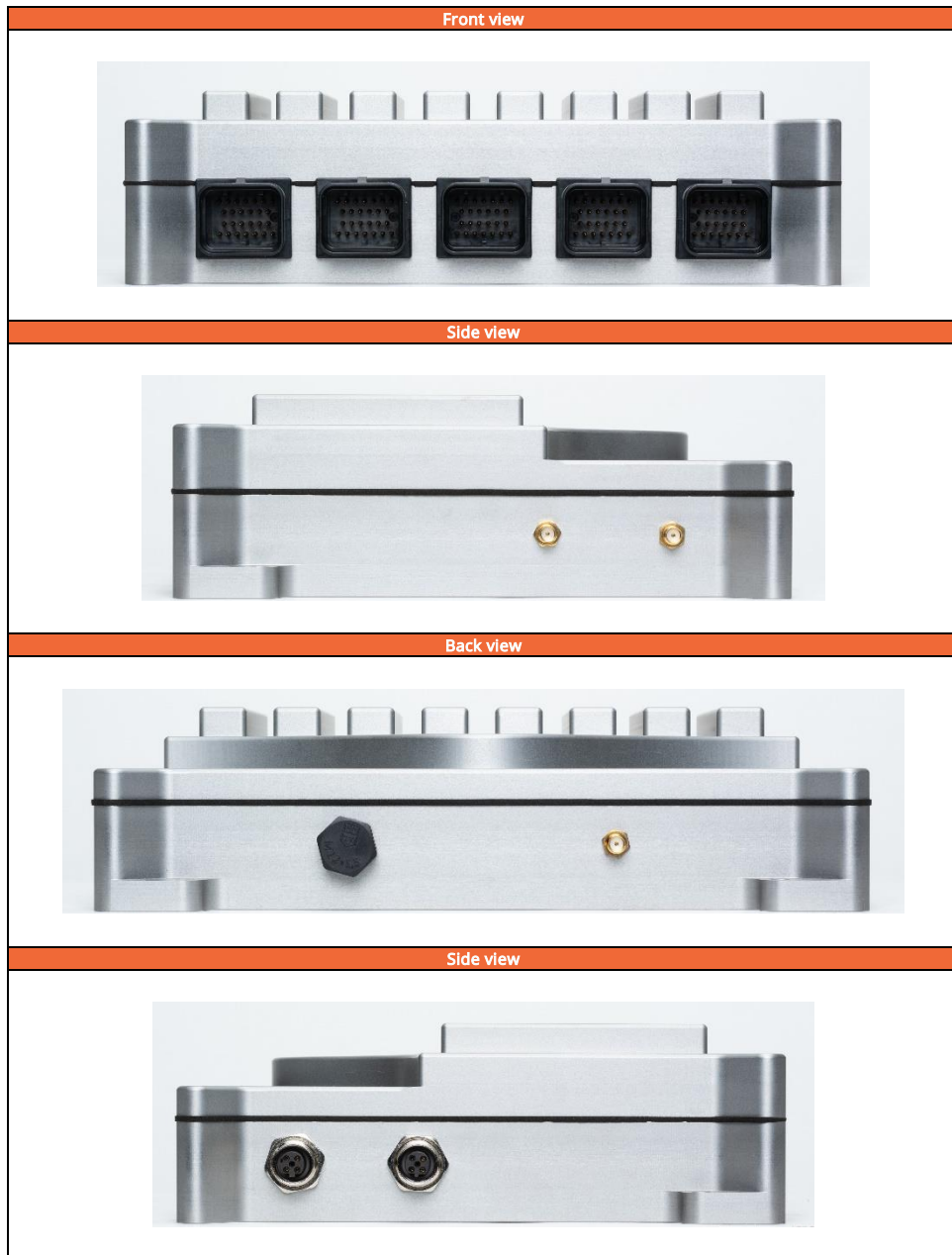
2.1. Overview

This paragraph gives a quick overview of the enclosures of the Moduline IV and Moduline Mini I. The Moduline Display I is still in development, so drawings have been added instead of product images.



2.1.1. Moduline IV

Pictured below is the enclosure of the Moduline IV.



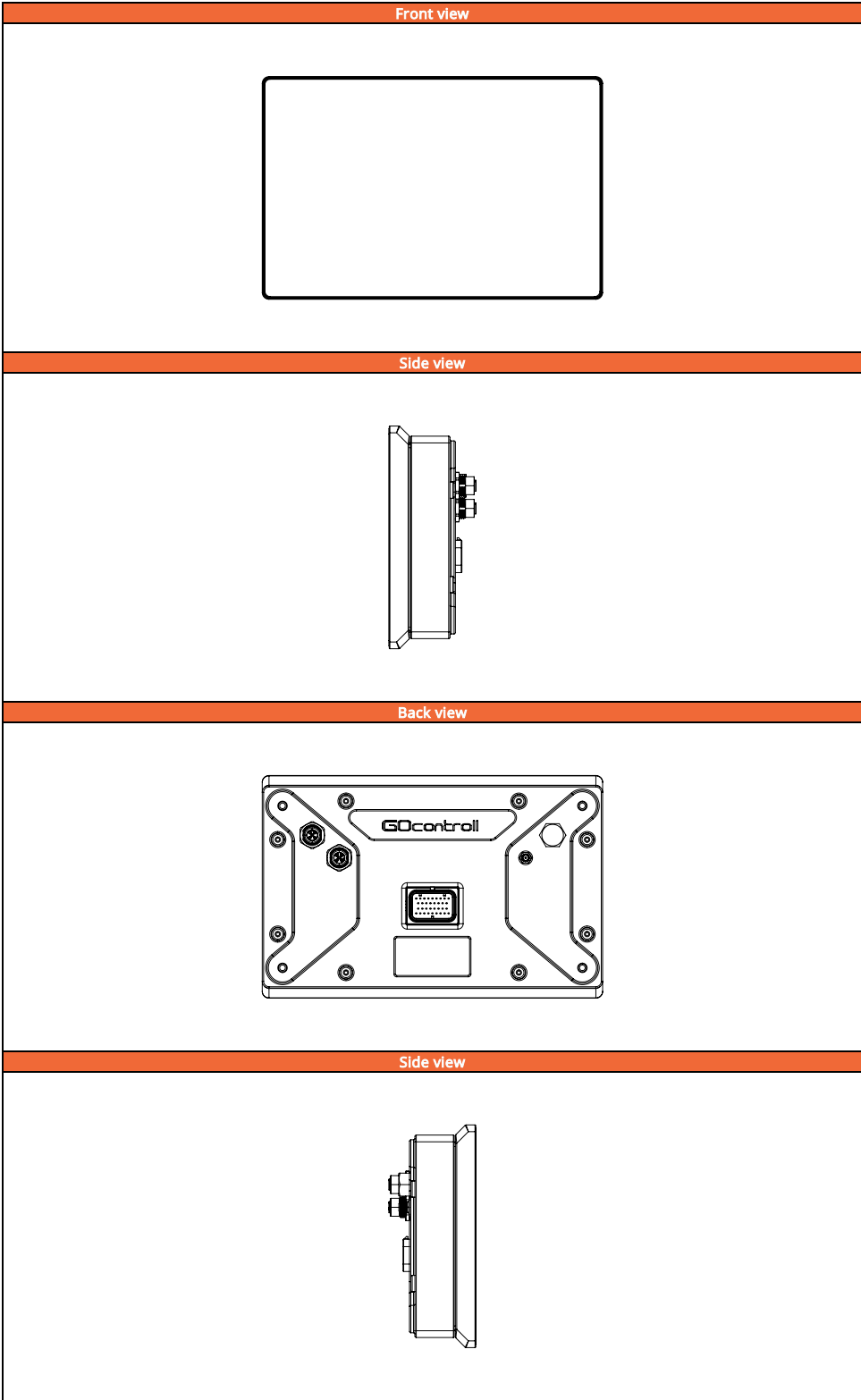
2.1.2. Moduline Mini I

Pictured below is the enclosure of the Moduline Mini I.



2.1.3. Moduline Display I

Pictured below is the enclosure of the Moduline Display I.

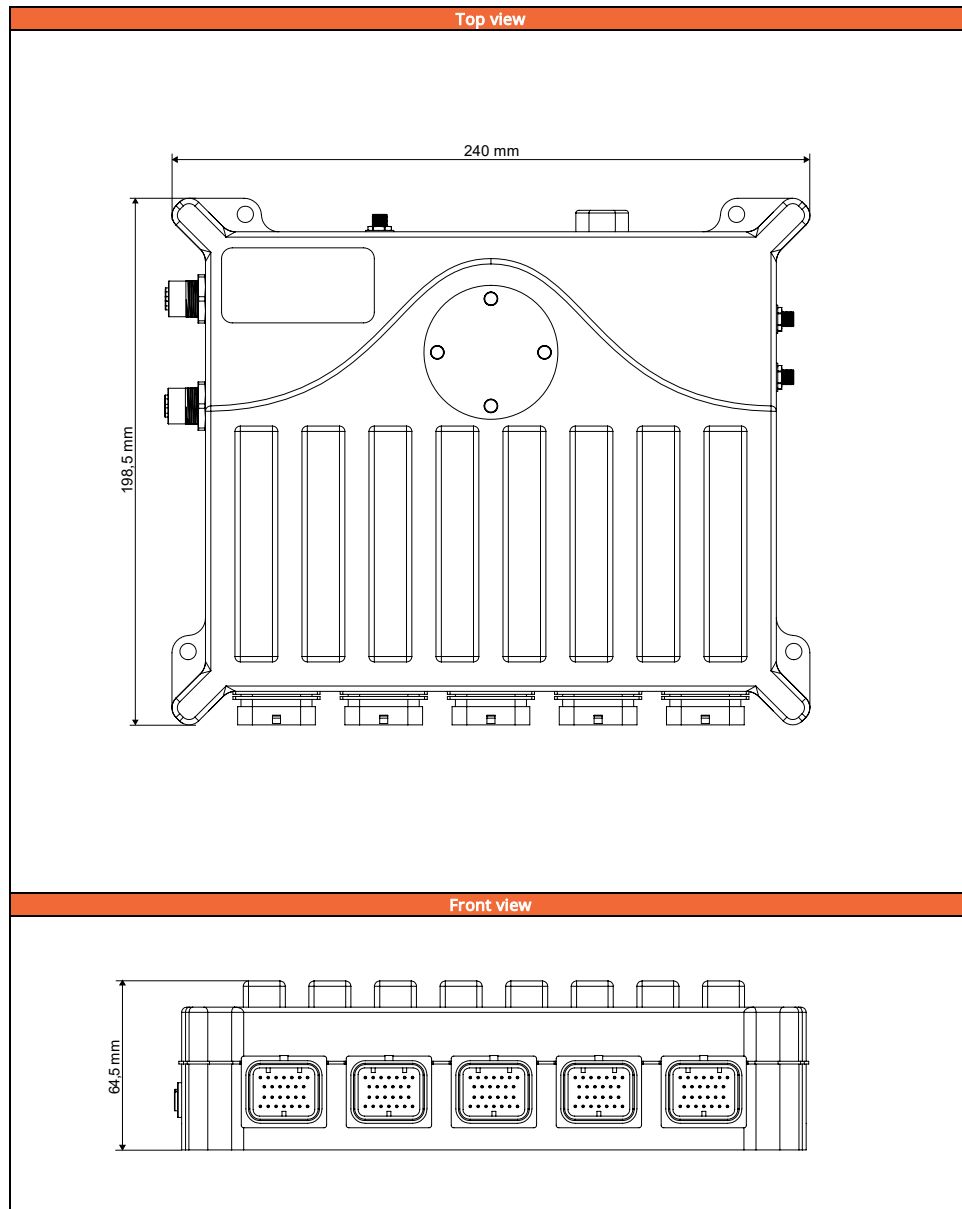


2.2. Dimensions

This paragraph describes the external dimensions of the Moduline series embedded controllers.

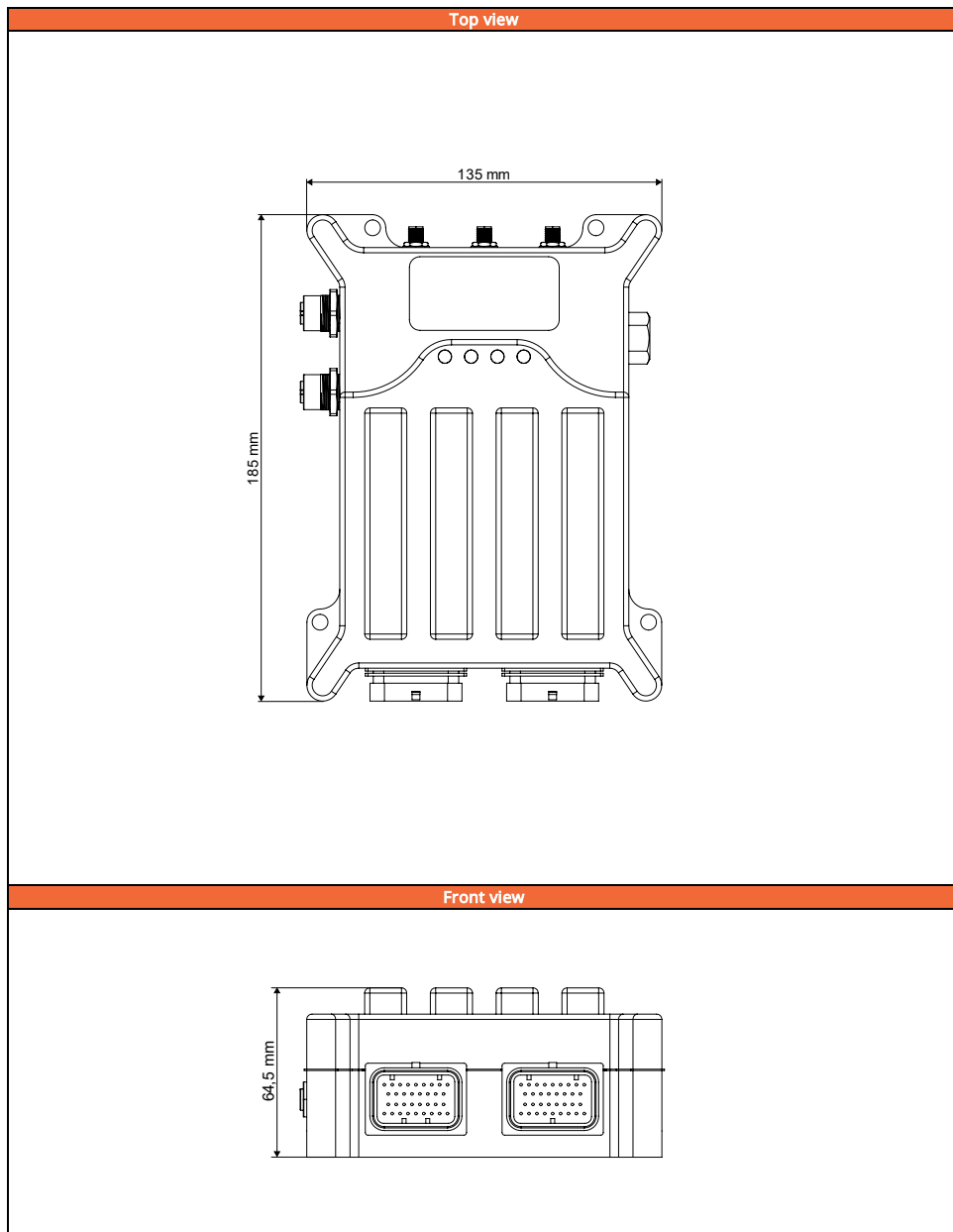
2.2.1. Moduline IV

Pictured below is a drawing with the external dimensions of the Moduline IV controller. A detailed 3D model of the controller can be supplied on request.



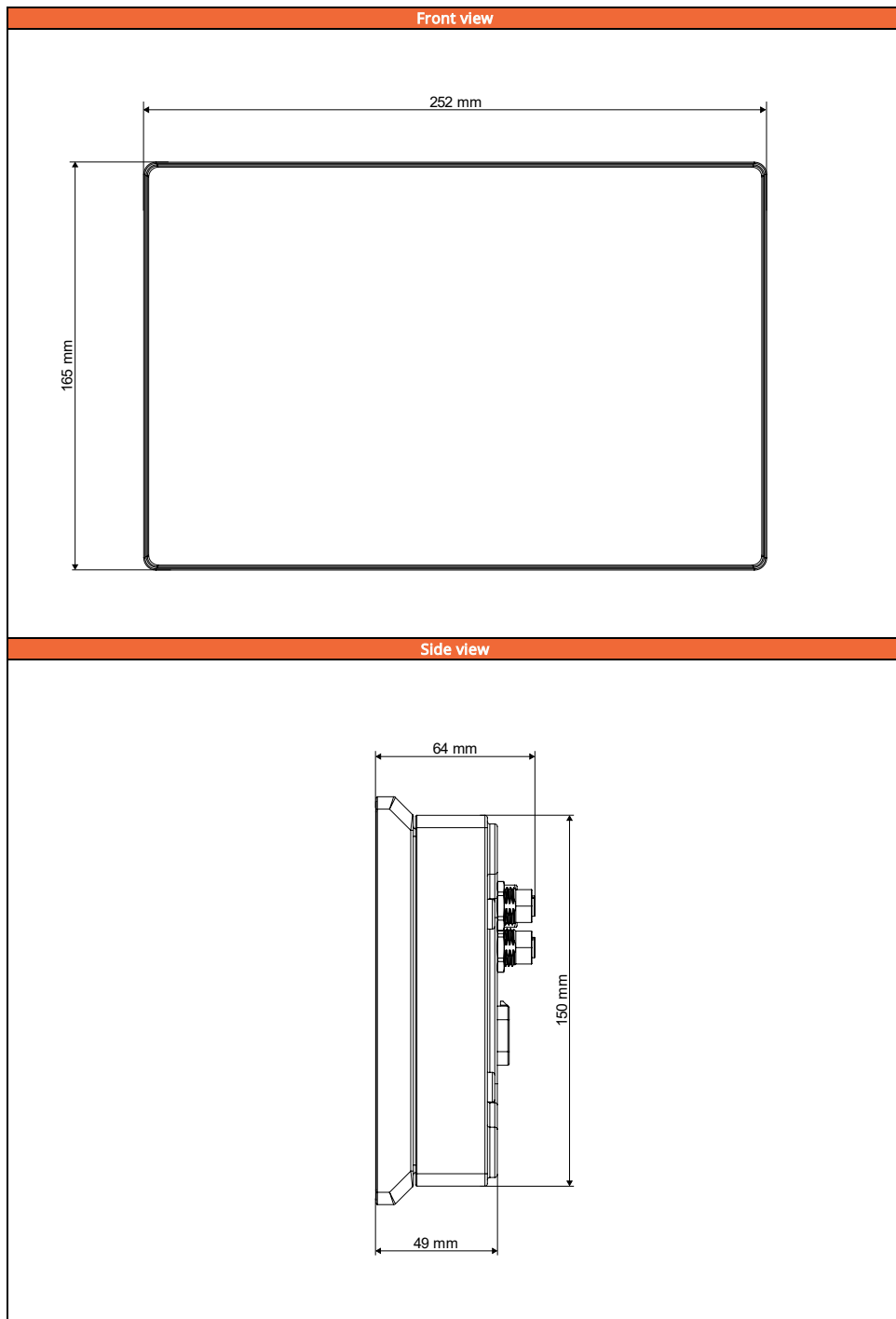
2.2.2. Moduline Mini I

Pictured below is a drawing with the external dimensions of the Moduline Mini I controller. A detailed 3D model of the controller can be supplied on request.



2.2.3. Moduline Display I

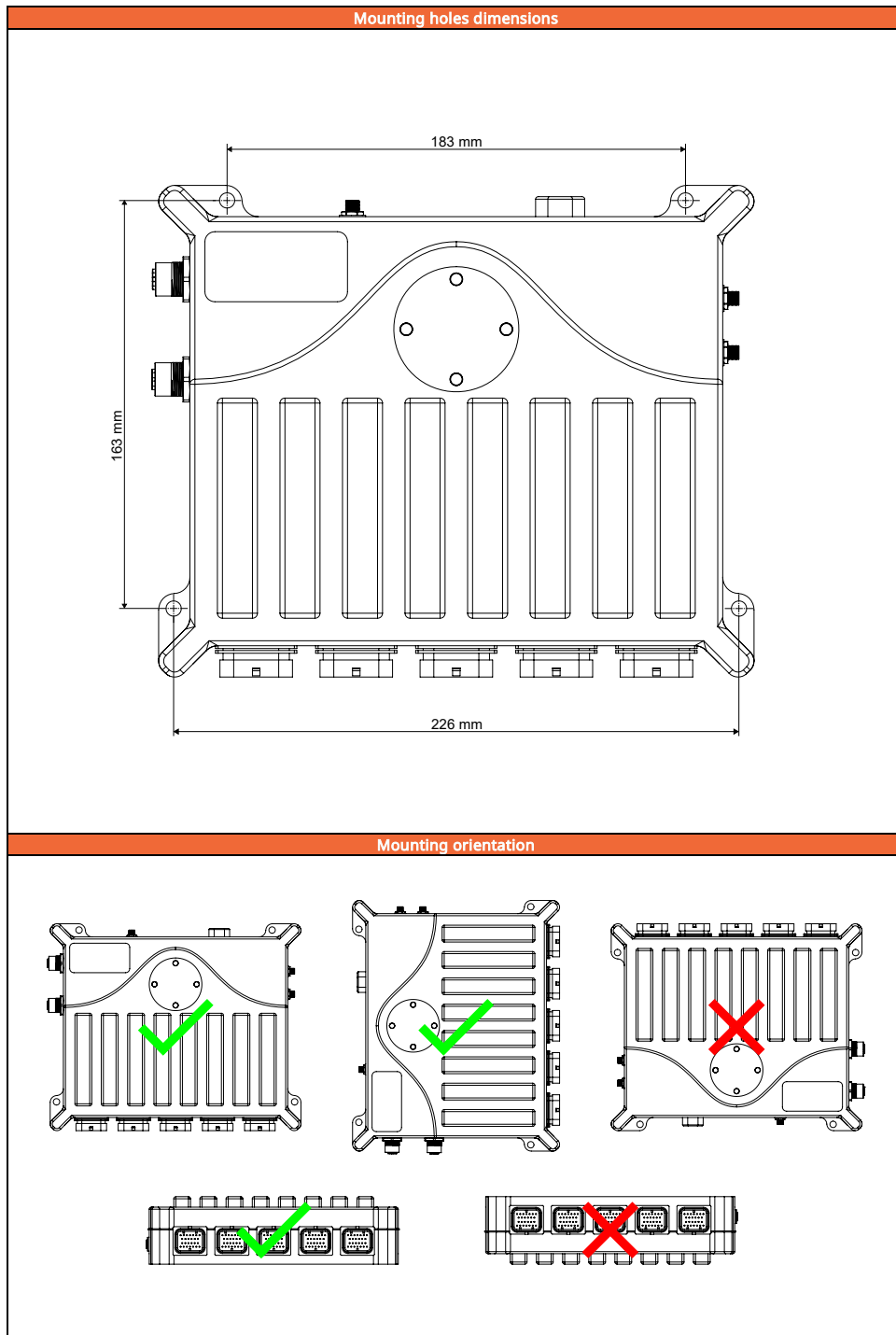
Pictured below is a drawing with the external dimensions of the Moduline Display I controller. A detailed 3D model of the controller can be supplied on request.



2.3. Mounting details

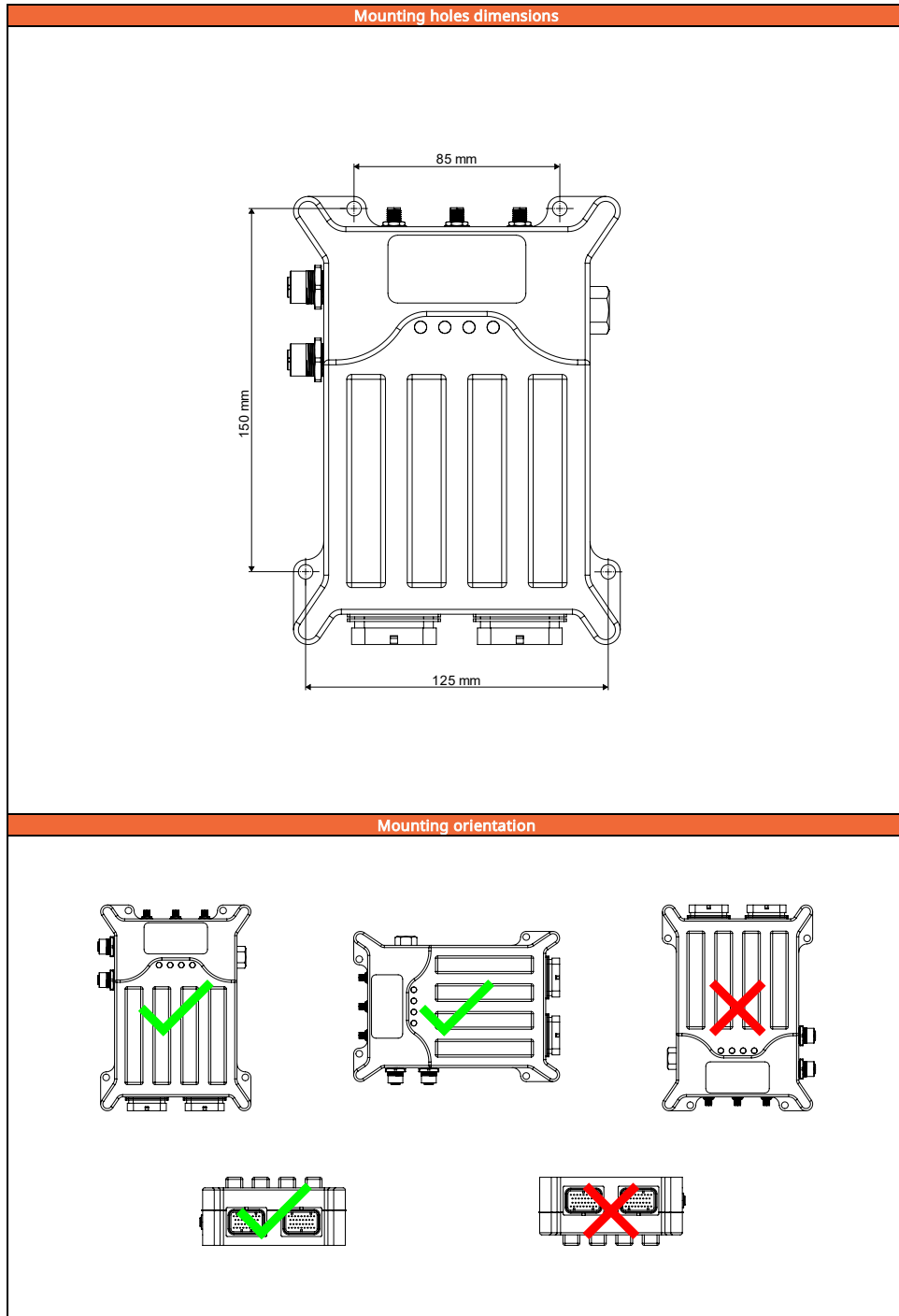
2.3.1. Moduline IV

The Moduline IV offers four built in mounting holes for secure mounting of the controller. We advise to use vibration dampeners to mount the controller. This ensures the controller does not become a structural member and reduces the harsh vibrations. To prevent any issues with water ingress in the automotive connectors when not installed, it is strongly recommended to follow the mounting orientation instructions listed down below.



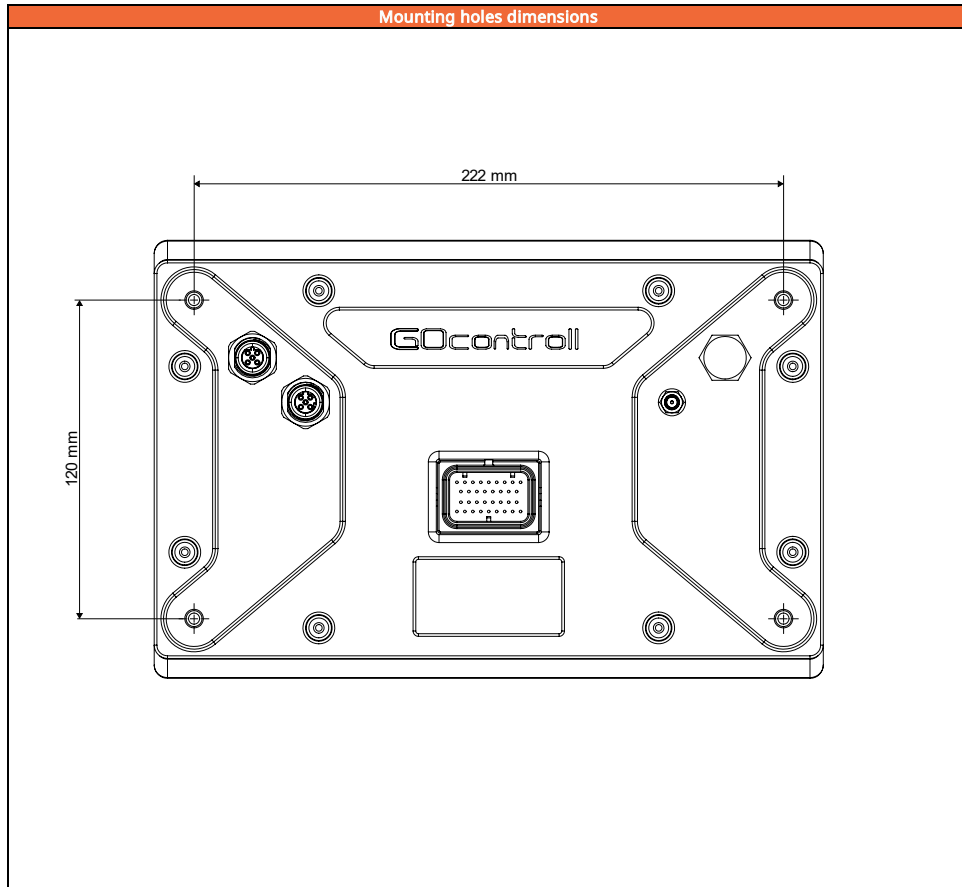
2.3.2. Moduline Mini I

The Moduline Mini I offers four built in mounting holes for secure mounting of the controller. We advise to use vibration dampeners to mount the controller. This ensures the controller does not become a structural member and reduces the harsh vibrations. To prevent any issues with water ingress in the automotive connectors when not installed, it is strongly recommended to follow the mounting orientation instructions listed down below.



2.3.3. Moduline Display I

The Moduline Display I offers four built in mounting holes for secure mounting of the controller. We advise to use vibration dampeners to mount the controller. This ensures the controller does not become a structural member and reduces the harsh vibrations.



2.3.4. Mounting hardware

This paragraph gives a clear description of the mounting hardware used to mount the Moduline embedded controllers. The controllers are designed to cope with the harsh conditions of automotive applications, but it is strongly recommended to use vibration dampers to mount the controllers. Specifications of two commonly used vibration dampers are listed down below. Alongside these vibration dampers, the corresponding screws are listed down below.

The controllers can be mounted with M5 screws. Listed below are the specifications for M5 hardware.

Anti-vibration bobbin mount type B – cylindrical M5			
	Specifications		
	D	15	[mm]
	H	15	[mm]
	M	5	[mm]
	t	5	[mm]
	I	10	[mm]
	Color	Black	
	Hardness	55 ±5	Shore A°
	Material A	NR	
	Material B	St37	
Legend			
D=diameter, H=height, I=length of thread, M=thread size, Mat. A=type of rubber, Mat. B=Material metal components, Hardness=Shore-A hardness of the rubber			

Hexagon socket button head screw ISO 7380-1 M5			
	Specifications		
	dk	9.5	[mm]
	k	2.75	[mm]
	L	14.0	[mm]
	D	5.0	[mm]
	s	3.0	[mm]
	Legend		
dk=head diameter, k=head height, L=length of thread, d=thread size, s=tool size			

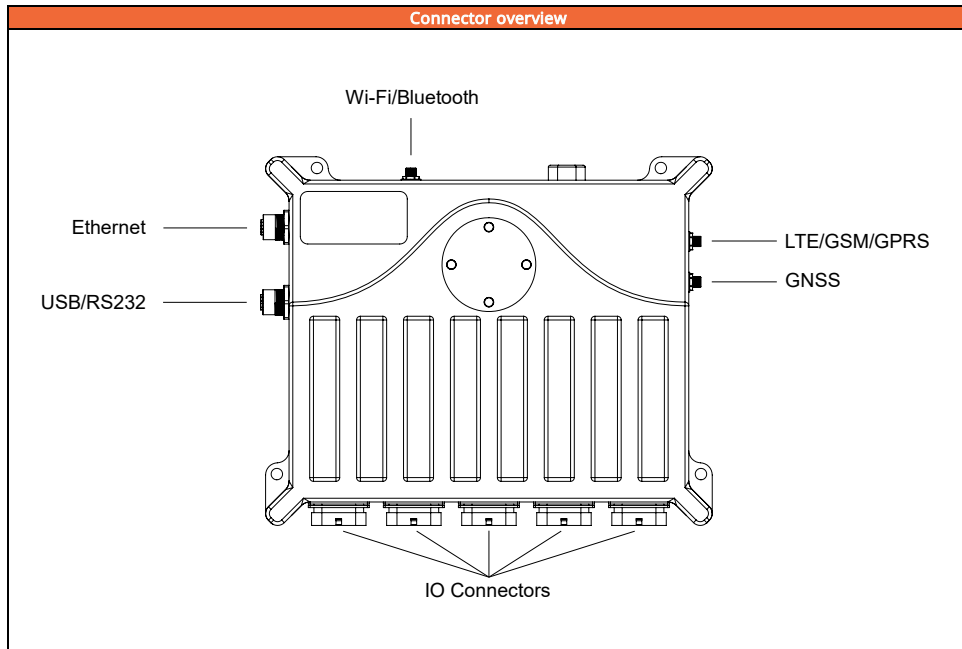
Torx socket button head screw ISO 7380-1 M5			
	Specifications		
	dk	9.5	[mm]
	k	2.75	[mm]
	L	14.0	[mm]
	D	5.0	[mm]
	TX	25	
	Legend		
dk=head diameter, k=head height, L=length of thread, d=thread size, s=tool size			

3. Connectors

3.1. Overview

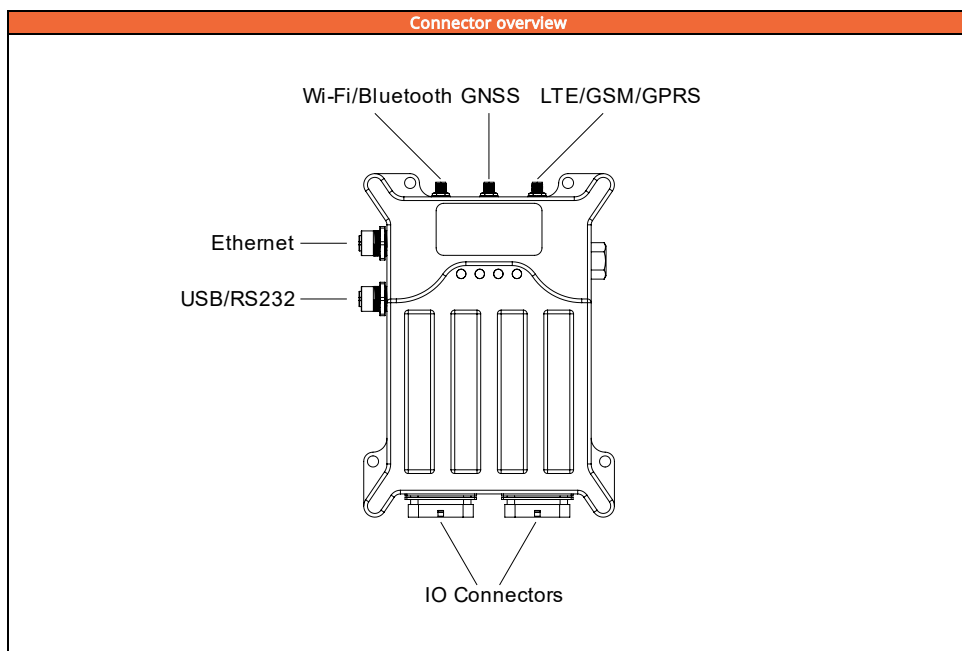
3.1.1. Moduline IV

The Moduline IV controller is equipped with five automotive IO connectors, two M12 connectors and three SMA connectors.



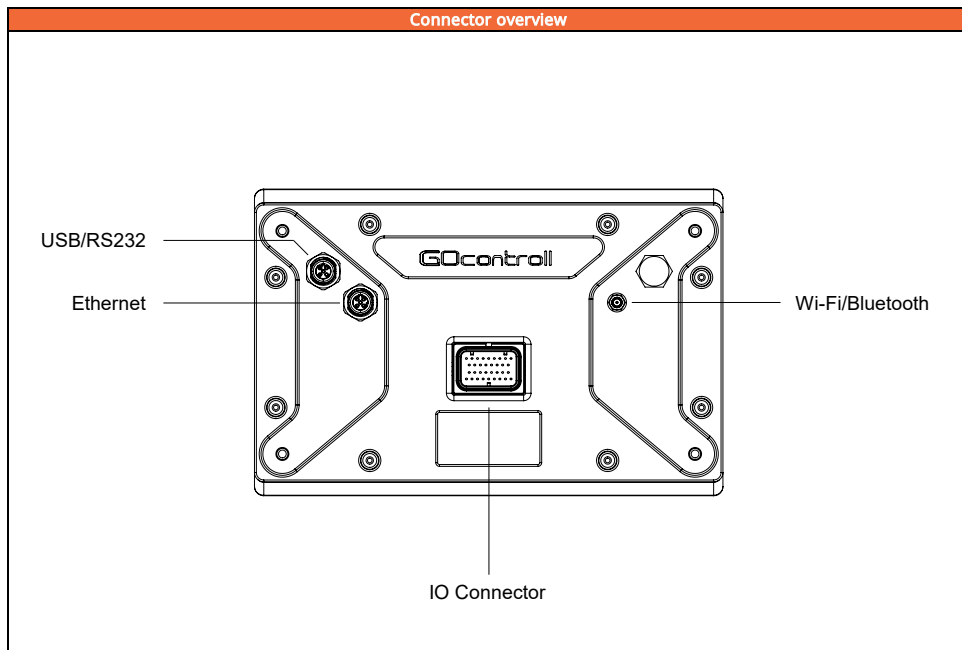
3.1.2. Moduline Mini I

The Moduline Mini I controller is equipped with two automotive IO connectors, two M12 connectors and three SMA connectors.



3.1.3. Moduline Display I

The Moduline Display I controller is equipped with one automotive IO connector, two M12 connectors and one SMA connector.




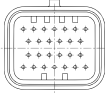
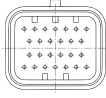
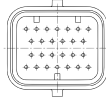
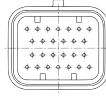
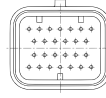
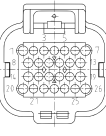
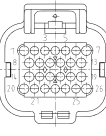
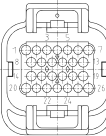
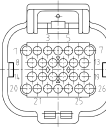
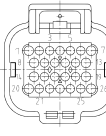
3.2. IO connectors

The IO connectors provide a waterproof and robust connection to controller specific signals and all the IO signals from installed Moduline compatible IO modules.

CAUTION: CONNECTORS MAY NEVER BE HOT PLUGGED! REMOVE POWER BEFORE REMOVING OR INSTALLING CONNECTORS!


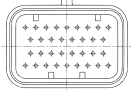
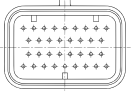
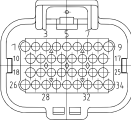
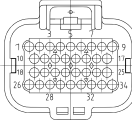
3.2.1. Moduline IV

The five automotive IO connectors on de Moduline IV provide not only up to 80 IO's, but also 4 CAN bus interfaces, a LIN bus interface, the power supply, a reset input and three enable inputs.

Controller				
				
Connector				
E	D	C	B	A
Pin Header				
				
6473423-2	6473423-1	2-6437285-8	9-6437287-9	9-6437287-8
Plug Housing				
				
1473416-2	1473416-1	2-1437285-2	3-1437290-8	3-1437290-7

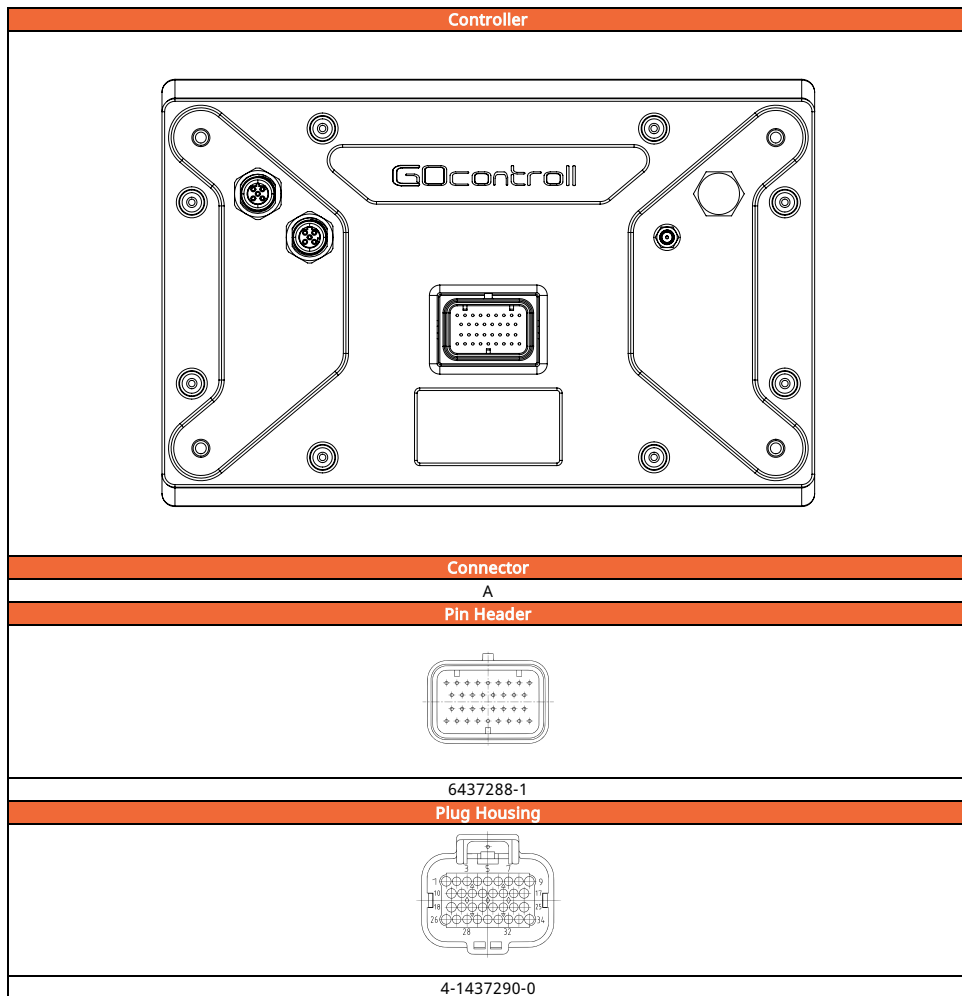
3.2.2. Moduline Mini I

The two automotive IO connectors on the Moduline Mini I provide not only up to 40 IO's, but also 2 CAN bus interfaces, the power supply, a reset input and three enable inputs.

Controller	
	
Connector	
B	A
Pin Header	
	
6437288-2	6437288-1
Plug Housing	
	
4-1437290-1	4-1437290-0

3.2.3. Moduline Display I

The automotive IO connector on the Moduline Display I provides not only up to 20 IO's, but also 2 CAN bus interfaces, the power supply and one enable input.



3.2.4. Parts and accessories

The Moduline controllers use SUPERSEAL 1.0 connectors from TE-Connectivity. This paragraph describes the corresponding parts and accessories to use with these connectors.

Stamped & formed contacts

The SUPERSEAL 1.0 mm connectors commonly use the AMP Superseal double spring, stamped & formed contact system.

Size	Receptacle Strip Form	Wire Size (mm ²)	Insulation Diameter (mm)	Finish
1.0 mm	3-1447221-5	0.3	1.4 - 1.6	Copper alloy Gold over nickel (contact part), Tin over Nickel (crimp area)
	3-1447221-4	0.5	1.6 - 1.9	
	3-1447221-3	0.75 - 1.25	1.6 - 2.2	

Sealing plugs

Open cavities provide pathways for contaminants to enter the connectors. To maintain seal integrity, any unused cavity must be filled with the appropriate size sealing plug.

Size	Color	Finish
1.0 mm	White	4-1437284-3

Tooling

Tools are specific to the contact style. To create a proper crimp and achieve high performance specifications, contacts must be crimped with the recommended tooling.

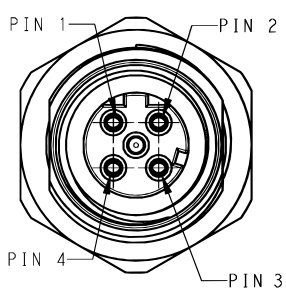
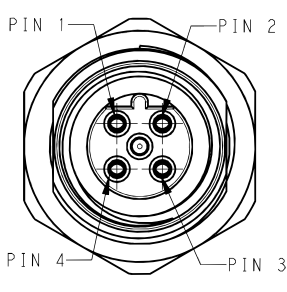
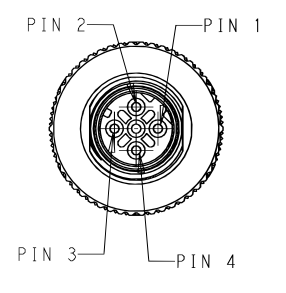
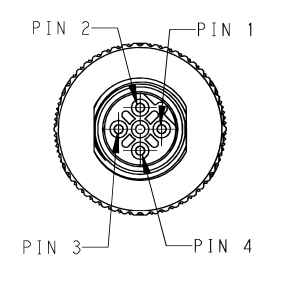
Contact P/N	Color	Finish
3-1447221-3	1454509-1	CERTI-CRIMP straight action hand tool with fixed dies
3-1447221-4		

3.3. M12 connectors

The two M12 connectors provide an Ethernet interface and an USB/RS232 interface. The latter is an assembly option and cannot be changed in software.

GOcontrol offers ready to use cable assemblies for the three different communication interfaces. For a RS232 connection to a laptop or PC, a RS232-to-usb converter is needed, which cannot be ordered through GOcontrol.

Cable assemblies can be ordered in various lengths and both angled and straight connector configurations. The M12 plugs listed in the table on the right are the suggested connectors if custom cabling is required.

Connector					
Ethernet			USB/RS232		
M12 Header					
					
D-CODE			B-CODE		
T4171110504-001			T4171110404-001		
M12 Plug					
					
D-CODE			B-CODE		
T4111511041-000			T4111411041-000		
Pin	Function	Description	Pin	Function	Description
1	RxP	Differential input receive	1	DATA+	Differential data bus
2	TxP	Differential output transmit	2	VBUS	Bus 5V
3	RxN	Differential input receive	3	GND	Bus GND
4	TxN	Differential output transmit	4	DATA-	Differential data bus

3.4. SMA connectors

The three SMA connectors provide antenna interfaces for the optional LTE/GSM modem, the optional Wi-Fi/Bluetooth modem and the optional GPS modem.

3.4.1. Wi-Fi/Bluetooth antenna

The Moduline controllers offer a Wi-Fi and a Bluetooth connection with an optional module. The specifications of the antenna required for this interface are listed in the table below.

Attribute	Value
Type	Passive
Minimum Frequency	2.4 GHz
Maximum Frequency	2.5 Ghz
Gain	>5,3 dBi
Connector	SMA Male
Number of Bands	1 Band

3.4.2. GNSS antenna

The Moduline controllers offer GNSS location positioning with an optional module. The specifications of the antenna required for this interface are listed in the table below.

Attribute	Value
Type	Passive
Minimum Frequency	1.575 GHz
Maximum Frequency	1.575 Ghz
Gain	>4 dBic
Connector	SMA Male
Number of Bands	1 Band

3.4.3. Cellular antenna

The Moduline controllers offer a cellular connection with an optional module. The specifications of the antenna required for this interface are listed in the table below.

Attribute	Value
Type	Passive
Minimum Frequency	3 GHz
Maximum Frequency	3 Ghz
Gain	>3.1 dBi
Connector	SMA Male
Number of Bands	1 Band

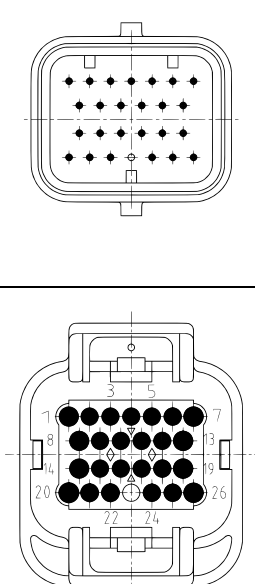
4. Controller specific connections

This chapter describes the controller specific connections on the Moduline IV and Moduline Mini I Embedded controllers.

CAUTION: CONNECTORS MAY NEVER BE HOT PLUGGED! REMOVE POWER BEFORE REMOVING OR INSTALLING CONNECTORS!

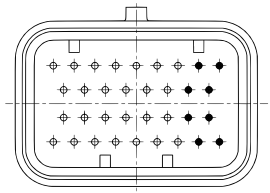
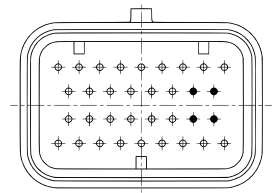
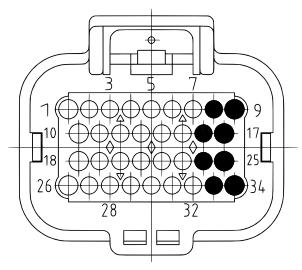
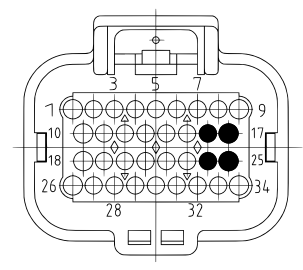
4.1. Moduline IV

The C connector on the Moduline IV houses all the controller specific connections. This includes the power supply, communication busses, a reset and multiple enable inputs.

Connector C (Middle connector)					
					
Pin	Function	Description	Pin	Function	Description
1	RESET	Reset (active high)	14	CAN1 LOW	CAN low line
2	K15	Contact 1 (active high)	15	CAN1 HIGH	CAN high line
3	K15	Contact 2 (active high)	16	CAN1 GND	Optional ground for shielding
4	K15	Contact 3 (active high)	17	CAN3 GND	Optional ground for shielding
5	K30	Supply	18	CAN3 HIGH	CAN high line
6	K30	Supply	19	CAN3 LOW	CAN low line
7	K30	Supply	20	CAN2 LOW	CAN low line
8	LIN BUS	LIN communication line	21	CAN2 HIGH	CAN high line
9	LIN SUP	LIN supply line (master)	22	CAN2 GND	Optional ground for shielding
10	LIN GND	Optional reference ground	23	NC	Not connected
11	CAN4 GND	Optional ground for shielding	24	K31	Ground
12	CAN4 HIGH	CAN high line	25	K31	Ground
13	CAN4 LOW	CAN low line	26	K31	Ground

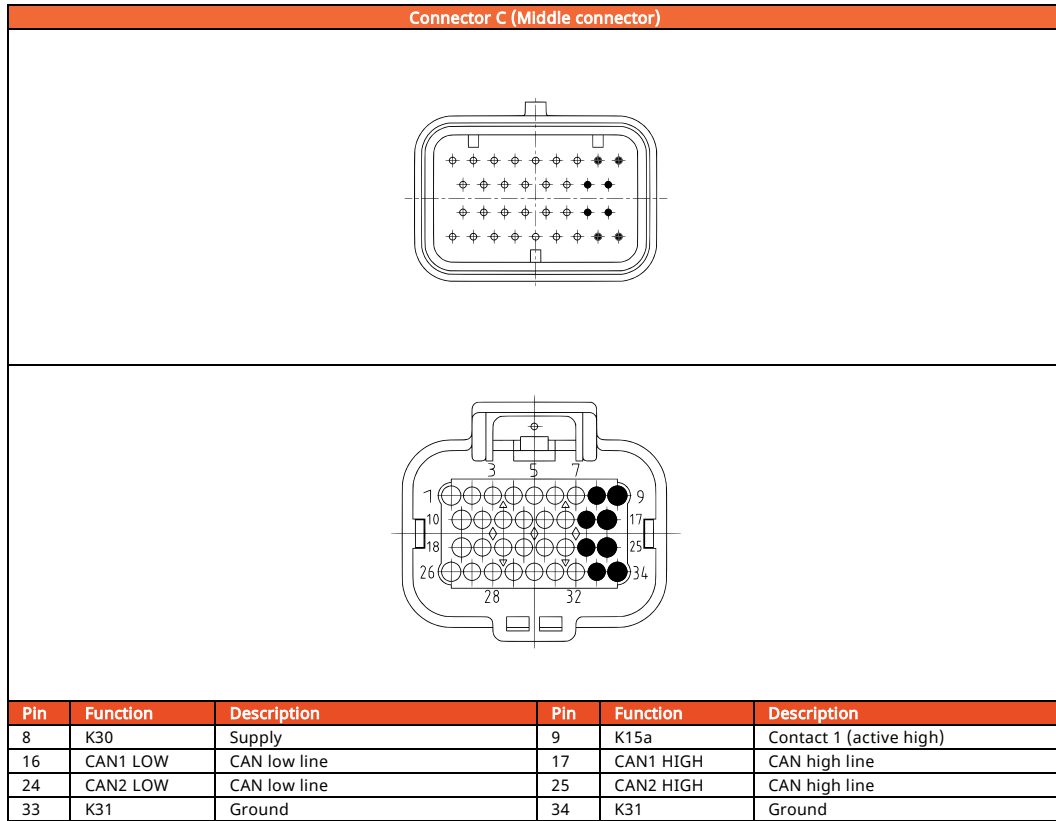
4.2. Moduline Mini I

Both the A and B connector on the Moduline Mini I house controller specific connections. This includes the power supply, communication busses, a reset and multiple enable inputs.

Connector B			Connector A		
					
					
Pin	Function	Description	Pin	Function	Description
8	K30	Supply	8	NC	Not connected
9	K30	Supply	9	NC	Not connected
16	RESET	Reset (active high)	16	K15B	Contact 2 (active high)
17	K15A	Contact 1 (active high)	17	K15C	Contact 3 (active high)
24	CAN1 LOW	CAN low line	24	CAN2 LOW	CAN low line
25	CAN1 HIGH	CAN high line	25	CAN2 HIGH	CAN high line
33	K31	Ground	33	NC	Not connected
34	K31	Ground	34	NC	Not connected


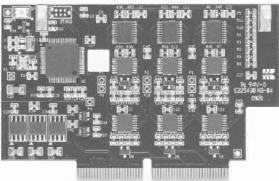
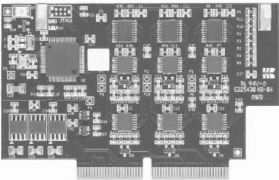

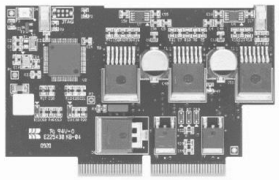

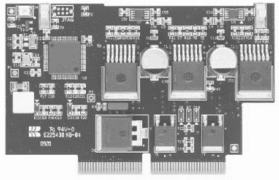
4.3. Moduline Display I

The main IO connector on the Moduline Display I houses all the controller specific connections alongside the IO connections coming from the installed IO modules. This includes the power supply, communication busses and one enable input.



5. IO Modules

This hardware manual includes the following IO modules:

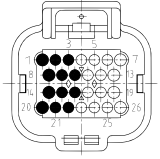
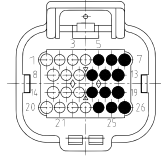
<p>6 Channel Input Module</p> 	<ul style="list-style-type: none"> • Measure sensor voltages from 0 to 24 Volt • Measure digital signals (low – high) 0 -24 Volt • Measure frequency signals from 0 to 10 kHz • Measure duty cycle signals (low duty and high duty) • Measure (rotational) speed signals • Measure encoder position (pulse counting) • Three channel dedicated 5V sensor supply • Software configurable input voltage range • Software configurable pull up and pull down resistors
<p>10 Channel Input Module</p> 	<ul style="list-style-type: none"> • Measure sensor voltages from 0 to 5 Volt • Measure digital signals (low – high) 0 -5 Volt • Measure frequency signals from 0 to 10 kHz • Measure duty cycle signals (low duty and high duty) • Measure (rotational) speed signals • Measure encoder position (pulse counting) • Two channel dedicated 5V sensor supply • Software configurable pull up and pull down resistor
<p>10 Channel 4-20mA Input Module</p> 	<ul style="list-style-type: none"> • Onboard high frequency signal processing • Overcurrent protection on all channels • Transient protected (IEC 61000-4-2, IEC 61643-321) • Protected 24 VDC built in power supply • Onboard MMC for high frequency data logging • Wire break detection on all channels
<p>6 Channel Output Module</p> 	<ul style="list-style-type: none"> • Bi directional control of inductive and resistive actuators • High side or low side actuator control as switch (on-off) • High side or low side actuator control with duty cycle (0-100%) • Half bridge actuator control • Full bridge actuator control (configuration requires 2 output ports) • Peak and hold functionality • Current controlled actuators • Current measurement per channel
<p>10 Channel Output Module</p> 	<ul style="list-style-type: none"> • Control of inductive and resistive actuators • High side actuator control as switch (on-off) • High side actuator control with duty cycle (0-100%) • Maximum current rating of 1A per channel
<p>2 Channel Power Bridge Output Module</p> 	<ul style="list-style-type: none"> • Bi directional control of inductive and resistive actuators • High side or low side actuator control as switch (on-off) • High side or low side actuator control with duty cycle (0-100%) • Half bridge actuator control • Full bridge actuator control (configuration requires 2 output ports) • Peak and hold functionality • Current controlled actuators • Current measurement per channel
<p>Argo-Anleg IR Module</p> 	<ul style="list-style-type: none"> • Infrared encoder/decoder compliant with IrDA® Specification • Dedicated 5 VDC sensor supply • Three LED drivers, low side switching up to 10kHz • RS485 interface • RS232 interface • CANbus interface • Two half bridge drivers

5.1. Moduline 6 Channel Input Module

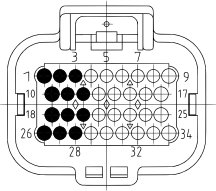
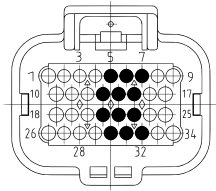
5.1.1. Specifications

	Measuring range	Min	Nom	Max	Unit
Input voltage range		0		24	Volt
Analog input sample resolution	0 – 5 V		12		Bit
	0 – 12 V		12		Bit
	0 – 24 V		12		Bit
Analog input sample frequency		0.1	1	10	kHz
Analog filter samples		1		1000	Samples
Digital input (low voltage)	0 – 5 V			1.5	Volt
	0 – 12 V			3.6	Volt
	0 – 24 V			7.2	Volt
Digital input (high voltage)	0 – 5 V	3.0			Volt
	0 – 12 V	7.2			Volt
	0 – 24 V	14.4			Volt
Input impedance (configuration dependent)	0 – 5 V		31.5		kΩ
	0 – 12 V		14.5		kΩ
	0 – 24 V		12.1		kΩ
Pull-up values			3.2		kΩ
			4.7		kΩ
			10		kΩ
Pull-down values			3.2		kΩ
			4.7		kΩ
			10		kΩ
5-volt sensor power supply current (per pin)				150	mA
Module weight			13		gram

5.1.2. Pinout on Moduline II, III & IV

Even module slots			Uneven module slots		
					
Pin	Function	Description	Pin	Function	Description
1	SUPPLY	5V sensor supply	5	SUPPLY	5V sensor supply
2	SUPPLY	5V sensor supply	6	SUPPLY	5V sensor supply
3	SUPPLY	5V sensor supply	7	SUPPLY	5V sensor supply
8	IN1	Signal in 1	11	IN5	Signal in 5
9	IN3	Signal in 3	12	IN3	Signal in 3
10	IN5	Signal in 5	13	IN1	Signal in 1
14	IN2	Signal in 2	17	IN6	Signal in 6
15	IN4	Signal in 4	18	IN4	Signal in 4
16	IN6	Signal in 6	19	IN2	Signal in 2
20	GROUND	Sensor ground	24	GROUND	Sensor ground
21	GROUND	Sensor ground	25	GROUND	Sensor ground
22	GROUND	Sensor ground	26	GROUND	Sensor ground

5.1.3. Pinout on Moduline Mini I and Moduline Display I

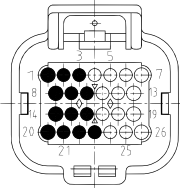
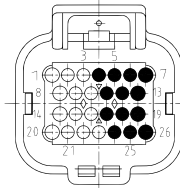
Even module slots			Uneven module slots		
					
Pin	Function	Description	Pin	Function	Description
1	SUPPLY	5V sensor supply	5	SUPPLY	5V sensor supply
2	SUPPLY	5V sensor supply	6	SUPPLY	5V sensor supply
3	SUPPLY	5V sensor supply	7	SUPPLY	5V sensor supply
10	IN1	Signal in 1	13	IN5	Signal in 5
11	IN3	Signal in 3	14	IN3	Signal in 3
12	IN5	Signal in 5	15	IN1	Signal in 1
18	IN2	Signal in 2	21	IN6	Signal in 6
19	IN4	Signal in 4	22	IN4	Signal in 4
20	IN6	Signal in 6	23	IN2	Signal in 2
26	GROUND	Sensor ground	30	GROUND	Sensor ground
27	GROUND	Sensor ground	31	GROUND	Sensor ground
28	GROUND	Sensor ground	32	GROUND	Sensor ground

5.2. Moduline 10 Channel Input Module

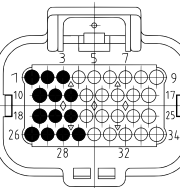
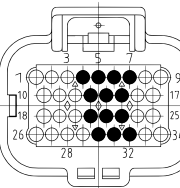
5.2.1. Specifications

	Measuring range	Min	Nom	Max	Unit
Input voltage range		0		5	Volt
Analog input sample resolution	0 – 5 V		12		Bit
Analog input sample frequency			1	10	kHz
Analog filter samples		1		1000	Samples
Digital input low voltage	0 – 5 V			1.5	Volt
Digital input high voltage	0 – 5 V	3.0			Volt
Input impedance (configuration dependent)	0 – 5 V		315		kΩ
Pull up values			3.2		kΩ
			4.7		kΩ
			10		kΩ
			1		kΩ
Pull down values					kΩ
5-volt sensor power supply current (per pin)				400	mA
Module weight			13		gram

5.2.2. Pinout on Moduline II, III & IV

Even module slots			Uneven module slots		
					
Pin	Function	Description	Pin	Function	Description
1	SUPPLY	5V sensor supply	4	IN10	Signal in 10
2	SUPPLY	5V sensor supply	5	IN9	Signal in 9
3	IN9	Signal in 9	6	SUPPLY	5V sensor supply
8	IN1	Signal in 1	7	SUPPLY	5V sensor supply
9	IN3	Signal in 3	11	IN5	Signal in 5
10	IN5	Signal in 5	12	IN3	Signal in 3
14	IN2	Signal in 2	13	IN1	Signal in 1
15	IN4	Signal in 4	17	IN6	Signal in 6
16	IN6	Signal in 6	18	IN4	Signal in 4
20	GROUND	Sensor ground	19	IN2	Signal in 2
21	IN7	Signal in 7	24	IN8	Signal in 8
22	IN8	Signal in 8	25	IN7	Signal in 7
23	IN10	Signal in 10	26	GROUND	Sensor ground

5.2.3. Pinout on Moduline Mini I and Moduline Display I

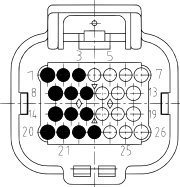
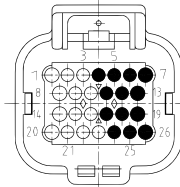
Even module slots			Uneven module slots		
					
Pin	Function	Description	Pin	Function	Description
1	SUPPLY	5V sensor supply	4	IN10	Signal in 10
2	SUPPLY	5V sensor supply	5	IN9	Signal in 9
3	IN9	Signal in 9	6	SUPPLY	5V sensor supply
10	IN1	Signal in 1	7	SUPPLY	5V sensor supply
11	IN3	Signal in 3	13	IN5	Signal in 5
12	IN5	Signal in 5	14	IN3	Signal in 3
18	IN2	Signal in 2	15	IN1	Signal in 1
19	IN4	Signal in 4	21	IN6	Signal in 6
20	IN6	Signal in 6	22	IN4	Signal in 4
26	GROUND	Sensor ground	23	IN2	Signal in 2
27	IN7	Signal in 7	30	IN8	Signal in 8
28	IN8	Signal in 8	31	IN7	Signal in 7
29	IN10	Signal in 10	32	GROUND	Sensor ground

5.3. Moduline 4-20mA Input Module

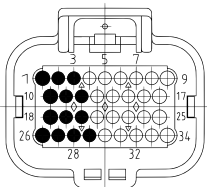
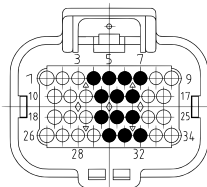
5.3.1. Specifications

	Measuring range	Min	Nom	Max	Unit
Full scale range		0		25	mA
Analog input sample resolution	4-20mA		12		Bit
Analog input sample frequency			1	10	kHz
Analog filter samples		1		1000	Samples
Module weight			13		gram

5.3.2. Pinout on Moduline II, III & IV

Even module slots			Uneven module slots		
					
Pin	Function	Description	Pin	Function	Description
1	IN1	Signal in 1	4	IN10	Signal in 10
2	IN4	Signal in 4	5	IN7	Signal in 7
3	IN7	Signal in 7	6	IN4	Signal in 4
8	IN2	Signal in 2	7	IN1	Signal in 1
9	IN5	Signal in 5	11	IN8	Signal in 8
10	IN8	Signal in 8	12	IN5	Signal in 5
14	IN3	Signal in 3	13	IN2	Signal in 2
15	IN6	Signal in 6	17	IN9	Signal in 9
16	IN9	Signal in 9	18	IN6	Signal in 6
20	GROUND	Sensor ground	19	IN3	Signal in 3
21	GROUND	Sensor ground	24	GROUND	Sensor ground
22	GROUND	Sensor ground	25	GROUND	Sensor ground
23	IN10	Signal in 10	26	GROUND	Sensor ground

5.3.3. Pinout on Moduline Mini and Moduline Display I

Even module slots			Uneven module slots		
					
Pin	Function	Description	Pin	Function	Description
1	IN1	Signal in 1	4	IN10	Signal in 10
2	IN4	Signal in 4	5	IN7	Signal in 7
3	IN7	Signal in 7	6	IN4	Signal in 4
10	IN2	Signal in 2	7	IN1	Signal in 1
11	IN5	Signal in 5	13	IN8	Signal in 8
12	IN8	Signal in 8	14	IN5	Signal in 5
18	IN3	Signal in 3	15	IN2	Signal in 2
19	IN6	Signal in 6	21	IN9	Signal in 9
20	IN9	Signal in 9	22	IN6	Signal in 6
26	GROUND	Sensor ground	23	IN3	Signal in 3
27	GROUND	Sensor ground	30	GROUND	Sensor ground
28	GROUND	Sensor ground	31	GROUND	Sensor ground
29	IN10	Signal in 10	32	GROUND	Sensor ground

5.4. Moduline 6 Channel Output Module

5.4.1. Specifications

	Min	Nom	Max	Unit
Supply rail voltage (normal operation)	8		32	Volt
Nominal load current for each channel*			3.5	A
Peak load current for each channel*			4	A
Switching frequency (duty cycle selected)	0		10	kHz
Duty cycle resolution		1		%
Module weight		29		gram

* The maximum total module current consumption may not exceed 15A

CAUTION: CONNECTORS MAY NEVER BE HOT PLUGGED! REMOVE POWER BEFORE REMOVING OR INSTALLING CONNECTORS!

5.4.2. Pinout on Moduline II, III & IV

Even module slots			Uneven module slots		
Pin	Function	Description	Pin	Function	Description
1	SUPPLY	Module supply	5	SUPPLY	Module supply
2	SUPPLY	Module supply	6	SUPPLY	Module supply
3	SUPPLY	Module supply	7	SUPPLY	Module supply
8	OUT 1	Signal out 1	11	OUT 5	Signal out 5
9	OUT 3	Signal out 3	12	OUT 3	Signal out 3
10	OUT 5	Signal out 5	13	OUT 1	Signal out 1
14	OUT 2	Signal out 2	17	OUT 6	Signal out 6
15	OUT 4	Signal out 4	18	OUT 4	Signal out 4
16	OUT 6	Signal out 6	19	OUT 2	Signal out 2
20	GROUND	Module ground	24	GROUND	Module ground
21	GROUND	Module ground	25	GROUND	Module ground
22	GROUND	Module ground	26	GROUND	Module ground

5.4.3. Pinout on Moduline Mini I and Moduline Display I

Even module slots			Uneven module slots		
Pin	Function	Description	Pin	Function	Description
1	SUPPLY	Module supply	5	SUPPLY	Module supply
2	SUPPLY	Module supply	6	SUPPLY	Module supply
3	SUPPLY	Module supply	7	SUPPLY	Module supply
10	OUT 1	Signal out 1	13	OUT 5	Signal out 5
11	OUT 3	Signal out 3	14	OUT 3	Signal out 3
12	OUT 5	Signal out 5	15	OUT 1	Signal out 1
18	OUT 2	Signal out 2	21	OUT 6	Signal out 6
19	OUT 4	Signal out 4	22	OUT 4	Signal out 4
20	OUT 6	Signal out 6	23	OUT 2	Signal out 2
26	GROUND	Module ground	30	GROUND	Module ground
27	GROUND	Module ground	31	GROUND	Module ground
28	GROUND	Module ground	32	GROUND	Module ground

5.5. Moduline 10 Channel Output Module

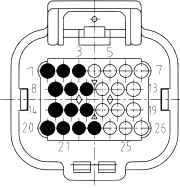
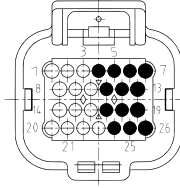
5.5.1. Specifications

	Min	Nom	Max	Unit
Supply rail voltage (normal operation)	8		32	Volt
Nominal load current for each channel*			1	A
Peak load current for each channel*			1.8	A
Switching frequency (duty cycle selected)	0		1	kHz
Duty cycle resolution		1		%
Module weight		29		gram

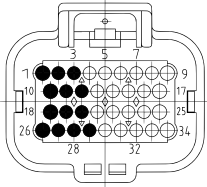
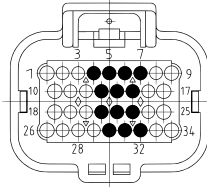
* The maximum total module current consumption may not exceed 15A

CAUTION: CONNECTORS MAY NEVER BE HOT PLUGGED! REMOVE POWER BEFORE REMOVING OR INSTALLING CONNECTORS!

5.5.2. Pinout on Moduline II, III & IV

Even module slots			Uneven module slots		
					
Pin	Function	Description	Pin	Function	Description
1	SUPPLY	Module supply	4	OUT10	Signal out 10
2	SUPPLY	Module supply	5	OUT9	Signal out 9
3	OUT9	Signal out 9	6	SUPPLY	Module supply
8	OUT1	Signal out 1	7	SUPPLY	Module supply
9	OUT 3	Signal out 3	11	OUT 5	Signal out 5
10	OUT 5	Signal out 5	12	OUT 3	Signal out 3
14	OUT 2	Signal out 2	13	OUT 1	Signal out 1
15	OUT 4	Signal out 4	17	OUT 6	Signal out 6
16	OUT 6	Signal out 6	18	OUT 4	Signal out 4
20	GROUND	Module ground	19	OUT 2	Signal out 2
21	OUT7	Signal out 7	24	OUT8	Signal out 8
22	OUT8	Signal out 8	25	OUT7	Signal out 7
23	OUT10	Signal out 10	26	GROUND	Module ground

5.5.3. Pinout on Moduline Mini I and Moduline Display I

Even module slots			Uneven module slots		
					
Pin	Function	Description	Pin	Function	Description
1	SUPPLY	Module supply	4	OUT10	Signal out 10
2	SUPPLY	Module supply	5	OUT9	Signal out 9
3	OUT9	Signal out 9	6	SUPPLY	Module supply
10	OUT 1	Signal out 1	7	SUPPLY	Module supply
11	OUT 3	Signal out 3	13	OUT 5	Signal out 5
12	OUT 5	Signal out 5	14	OUT 3	Signal out 3
18	OUT 2	Signal out 2	15	OUT 1	Signal out 1
19	OUT 4	Signal out 4	21	OUT 6	Signal out 6
20	OUT 6	Signal out 6	22	OUT 4	Signal out 4
26	GROUND	Module ground	23	OUT 2	Signal out 2
27	OUT7	Signal out 7	30	OUT8	Signal out 8
28	OUT8	Signal out 8	31	OUT7	Signal out 7
29	OUT10	Signal out 10	32	GROUND	Module ground

5.6. Moduline 2 Channel Power Bridge Output Module

5.6.1. Specifications

	Min	Nom	Max	Unit
Supply rail voltage	8		32	Volt
Nominal load current individual channels*			10	A
Peak load current individual channels			14	A
Nominal load current H-Bridge configuration			10	A
Peak load current H-Bridge configuration			14	A
Switching frequency (duty cycle selected)	0		10	kHz
Duty cycle resolution		1		%
Module weight (excluding cool plate)		25		gram

* The maximum total module current consumption may not exceed 15A

CAUTION: CONNECTORS MAY NEVER BE HOT PLUGGED! REMOVE POWER BEFORE REMOVING OR INSTALLING CONNECTORS!

5.6.2. Pinout on Moduline II, III & IV

Even module slots			Uneven module slots		
Pin	Function	Description	Pin	Function	Description
1	SUPPLY	Module supply	5	SUPPLY	Module supply
2	SUPPLY	Module supply	6	SUPPLY	Module supply
3	SUPPLY	Module supply	7	SUPPLY	Module supply
8	OUT1	Signal out 1	11	OUT1	Signal out 1
9	OUT1	Signal out 1	12	OUT1	Signal out 1
10	OUT1	Signal out 1	13	OUT1	Signal out 1
14	OUT2	Signal out 2	17	OUT2	Signal out 2
15	OUT2	Signal out 2	18	OUT2	Signal out 2
16	OUT2	Signal out 2	19	OUT2	Signal out 2
20	GROUND	Module ground	24	GROUND	Module ground
21	GROUND	Module ground	25	GROUND	Module ground
22	GROUND	Module ground	26	GROUND	Module ground

5.6.3. Pinout on Moduline Mini I and Moduline Display I

Even module slots			Uneven module slots		
Pin	Function	Description	Pin	Function	Description
1	SUPPLY	Module supply	5	SUPPLY	Module supply
2	SUPPLY	Module supply	6	SUPPLY	Module supply
3	SUPPLY	Module supply	7	SUPPLY	Module supply
10	OUT1	Signal out 1	13	OUT1	Signal out 1
11	OUT1	Signal out 1	14	OUT1	Signal out 1
12	OUT1	Signal out 1	15	OUT1	Signal out 1
18	OUT2	Signal out 2	21	OUT2	Signal out 2
19	OUT2	Signal out 2	22	OUT2	Signal out 2
20	OUT2	Signal out 2	23	OUT2	Signal out 2
26	GROUND	Module ground	30	GROUND	Module ground
27	GROUND	Module ground	31	GROUND	Module ground
28	GROUND	Module ground	32	GROUND	Module ground

5.7. Moduline IR Module

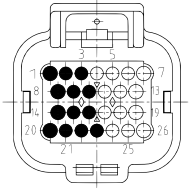
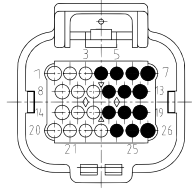
5.7.1. Specifications

	Min	Nom	Max	Unit
Supply rail voltage (normal operation)	8		32	Volt
Nominal load current for OUT1 & OUT2			3.5	A
Peak load current for OUT1 & OUT2			4	A
Switching frequency for OUT1 & OUT 2 (duty cycle selected)	0		10	kHz
Duty cycle resolution		1		%
Module weight		29		gram

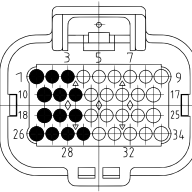
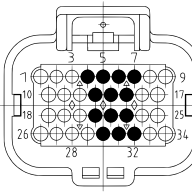
* The maximum total module current consumption may not exceed 5A

CAUTION: CONNECTORS MAY NEVER BE HOT PLUGGED! REMOVE POWER BEFORE REMOVING OR INSTALLING CONNECTORS!

5.7.2. Pinout on Moduline II, III & IV

Even module slots			Uneven module slots		
					
Pin	Function	Description	Pin	Function	Description
1	SUPPLY	Module supply	4	SUPPLY	5V/12V Sensor supply
2	RS485/RS232TX	RS485/RS232 TX output	5	RS485/RS232RX	RS485/RS232 RX input
3	RS485/RS232RX	RS485/RS232 RX input	6	RS485/RS232TX	RS485/RS232 TX output
8	OUT1	Signal out 1	7	SUPPLY	Module supply
9	LED A	LED out A	11	IR IN	IR emitter feedback input
10	IR IN	IR emitter feedback input	12	LED A	LED out A
14	OUT 2	Signal out 2	13	OUT 1	Signal out 1
15	LED B	LED out B	17	IR OUT	IR emitter output
16	IR OUT	IR emitter output	18	LED B	LED out B
20	GROUND	Module ground	19	OUT 2	Signal out 2
21	CAN LOW	CAN low line	24	CAN HIGH	CAN high line
22	CAN HIGH	CAN high line	25	CAN LOW	CAN low line
23	SUPPLY	5V/12V Sensor supply	26	GROUND	Module ground

5.7.3. Pinout on Moduline Mini I and Moduline Display I

Even module slots			Uneven module slots		
					
Pin	Function	Description	Pin	Function	Description
1	SUPPLY	Module supply	4	SUPPLY	5V/12V Sensor supply
2	RS485/232TX	RS485/RS232 TX output	5	RS485/232RX	RS485/RS232 RX input
3	RS485/232RX	RS485/RS232 RX input	6	RS485/232TX	RS485/RS232 TX output
10	OUT 1	Signal out 1	7	SUPPLY	Module supply
11	LED A	LED out A	13	IR IN	IR emitter feedback input
12	IR IN	IR emitter feedback input	14	LED A	LED out A
18	OUT 2	Signal out 2	15	OUT 1	Signal out 1
19	LED B	LED out B	21	IR OUT	IR emitter output
20	IR OUT	IR emitter output	22	LED B	LED out B
26	GROUND	Module ground	23	OUT 2	Signal out 2
27	CAN LOW	CAN low line	30	CAN HIGH	CAN high line
28	CAN HIGH	CAN high line	31	CAN LOW	CAN low line
29	SUPPLY	5V/12V Sensor supply	32	GROUND	Module ground