Monitor 6.5C – User Manual

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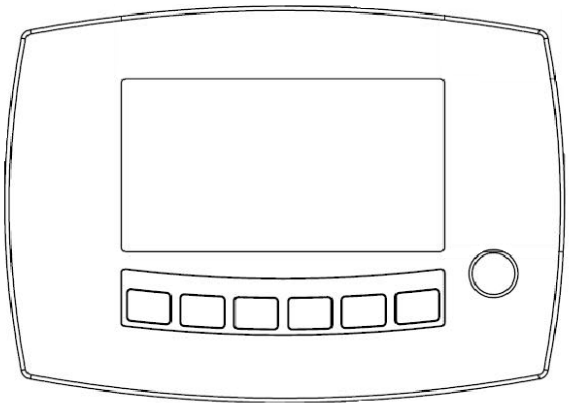

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Overview

TTControl Monitor 6.5C is an LCD module developed for automotive applications. Due to its high contrast and wide viewing angle, the screen is well-suited for off-highway use in vehicle cabins. There it fits perfectly to visualize machine parameters and assist the driver with up to three cameras to back up the vehicle.
This product is not intended as a stand-alone module but is designed for use with Vision, TTControl´s powerful visualization unit. A keyboard composed of six buttons placed on the housing surface is available to interact with the Vision control unit. The jog shuttle, a digital encoder with button function, allows very comfortable menu prompting.

Summary

This document describes the basic function of the hardware and gives an overview of the display's properties and its handling. Installation instructions as well as possible causes of failure and their solutions are provided to ease system set-up and maintenance. Detailed information about the connector's pinning and standard cabling helps you to integrate the modules.

Features

- 6.5“ LCD display with wide viewing angle and high contrast
- LVDS port for video streaming connection to Vision (Digital Video Interface)
- Communication interface to Vision
- Digital encoder for easy menu prompting (optional)
- Keyboard with 6 buttons
- Support of up to 3 external composite video camera systems
- Panel or cabin mounting
- Wide power supply range for use in 12V and 24V supply systems (6V to 34V)
- Certified according to *ISO 13766:1999*
- Protect against the water sprays and the powder (IP64 – to use in vehicle cabins)

Variants

Depending on the module's version, connection with up to three cameras is possible. Other features that vary are the digital encoder and the type of housing. The module is available as a panel version and as a cabin mount. Regarding the cabin mount option, TTControl offers a reliable system for affixing the monitor according to how hostile the environment is.

Image 1.1 Panel mount version

Image 1.2 Cabin mount version

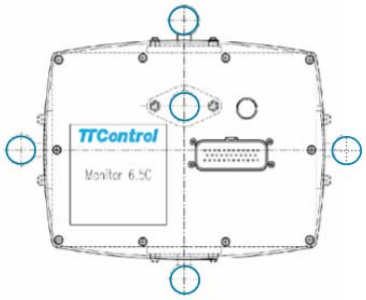


Image 1.3 RAM ball position options

All properties and features of a variant are given by its product code. Use the following table to identify the version you work with or to compose your product code.

Product code	Camera option	Encoder option	Housing	RAM ball position
x.xxx	1 = not available 2 = available	1 = not available 2 = available	0 = panel mount 1 = cabin mount v1.0 3 = cabin mount v2.0 5 = cabin mount v3.0	a = top b = right side (front view) c = bottom d = left side (front view) e = back side
e.g.: 2.10	√	-	panel mount	-
e.g.: 2.20	√	√	panel mount	-
e.g.: 2.25a	√	√	cabin mount v3.0	Stand mount on top

Table 11: Ordering information scheme (obsolete options are marked grey)

Camera Vision System

Monitor 6.5C is designed to produce the visualization of the data elaborated by Vision. The visualization unit controls the views of the cameras and displays the machine parameters. The produced video signal is streamed to the module using the LVDS standard.
For information transfer with the Vision system at runtime, a serial connection (RS485) is implemented. This allows the usage of the module's keyboard and the encoder to interact with the control unit and set parameters.

Image 1.4 Monitor 6.5C interaction with its accessories Vision and composite camera

Accessories

Composite camera

The Compact Camera is a highly recommended system for off-highway use. Aerodynamic and compact design in combination with very flexible mounting systems provide the best basis for optimal integration into an existing system. The camera produces a composite video signal and is supported by the Monitor 6.5C. Product code: ***HD720.00.0***

Image 1.5 Composite Camera

- The system is 100% waterproof (IP69) and can be safely cleaned with high pressure water or in a car wash.
- The camera's lens glass is heated, and provides a clear image when temperatures drop below the freezing point.
- The lens glass is chemically hardened, preventing cracks and damage from occurring.
- The cameras are corrosion-proof.
- The cameras are resistant to sunlight and provide a clear image in direct sun or low-lying sun conditions.
- The system is shock-and vibration-proof and complies with the strictest off-road requirements.

Standard cabling

Since Monitor 6.5C is used with the Vision control unit, standard cabling is offered. This cable harness includes all Vision I/O ports, communication interfaces with the proper connectors and explicit labels as well as power supply wires. In addition, the harness is extended with the 35-pin AMPSEAL plug and the camera connectors. The system can be composed easily by following the instructions included in chapter “Mechanical Drawings: Panel Mount Version” of this manual. All information necessary to implement a different cabling system is found in chapter “Mechanical Drawings: Cabin Mount Version V3”.

Full standard cabling product code: ***HD710.10.0***

- Vision: *Supply, CAN, LIN, Ethernet, IButton, Temperature Sensor, Digital inputs (28), Digital outputs (24), Serial, Debug interface*
- Vision – Monitor 6.5C: *Digital video interface (LVDS), RS485, Supply*
- Monitor 6.5C: *Composite camera (3x)*

Basic standard product code: ***HD710.11.0***

- Vision: *Supply*
- Vision – Monitor 6.5C: *Digital video interface (LVDS), RS485, Supply*
- Monitor 6.5C: *Composite camera (3x)*

Technical overview

General specification

Diagonal size	6.5" (16.5 cm) – 16:9 aspect ratio
Number of dots	400x3(W) x 240(H)
Active area	143.4 (W) x 79.3 (H) mm
Dot pitch	0.1195 (W) x 0.3305 (H) mm
LCD type	TFT (thin film transistor) active matrix
Luminance	180 cd / m^2 (transmissive mode)
View angle	V = -45 to +45 deg; H = -50 to +50 deg
Contrast ratio	140 (transmissive mode), 5 (reflective mode)
Backlight	cold cathode type
Backlight lifetime	10,000 hours (min) at +25°C (continuation)
Camera Interface	optional

Table 1.2: Absolute maximum rating

Environmental ratings

Temperature characteristics	
Operating temperature	-20°C to +65°C
Storage temperature	-40°C to +70°C
Protection classification IP64	
First digit – dust-proof: 6	No ingress of dust; complete protection against contact
Second digit – splashing water: 4	Water splashing against the enclosure from any direction shall have no harmful effect.

Table 1.3: Environmental ratings

Absolute maximum ratings

Supply voltage	6V - 34V
Maximum power consumption (three cameras and maximum backlight)	25 Watts
Overcurrent protection for each camera	300mA at 12V

Table 1.4: Absolute maximum ratings

User interface

Image 1.6 Example for a visualization user interface

The user interface consists of six keys and one jog shuttle encoder (rotary knob with push-button). All keys can be used to interact with Vision. Some visualizations show a virtual button on the screen's lower border in order to relate to the key. Mostly the jog shuttle is used for menu prompting and value adjustment. By turning the jog shuttle the display page can be switched or a value changed. Pushing the button of the jog shuttle is intuitively used to confirm the value or enter a sub-menu.

Mounting instructions

The module allocation should be well thought out. To provide the best possible working environment for the system, strong physical impacts and pressure washing should be avoided. Do not bend, crush or damage the cabling in any way.

Cabin mount version

This variant is affixed using an adjustable stand and a RAM ball. The RAM ball position on the housing surface depends on the version of Monitor 6.5C.

Image 1.7 Mounting example-cabin version

- Affix the base RAM ball (1) to the desired location using M4 screws.
- Stick the base RAM ball (1) and the Monitor 6.5C RAM ball (3) into the ends of the stand (2)
- Adjust the position to get the best viewing angle and close the stand's wing screw (2).

See chapter "Mechanical Drawings" for further information regarding the mechanical dimensions. Detailed information about connector pinning and cable setup is listed in chapter "Getting Started: Connectors and pinning".

Panel mount version

This module version is designed for easy mounting on a flat surface. Regardless of this installation mode the housing has the same resistance properties as the semi-detached cabin mount option.

Image 1.8 Mounting example-panel

- Use the exact dimension shown in chapter "Mechanical Drawings" to perform a compatible cut out and six drillings on a flat panel (3).
- Use the fitting rubber seal between the module (1) and the panel (3) to diminish vibration and seal the space between them to avoid water ingress.
- Affix the Monitor 6.5C with the integrated M4 screws (2) found on the back of Monitor 6.5C (1). Apply nylon insert lock nuts (DIN 985).

Getting started

The basis for a properly working system is good and reliable cabling. Our product assortment provides standard cabling which fits perfectly to Vision, Monitor 6.5C and camera connectors. All necessary connections are integrated and will ensure a securely working system to avoid malfunction.

Connection instructions for standard cabling

Vision and up to three cameras are connected with Monitor 6.5C through the 35-pin AMPSEAL plug. Using the standard cabling, all proper connections are found intuitively since there are different plugs for each component.

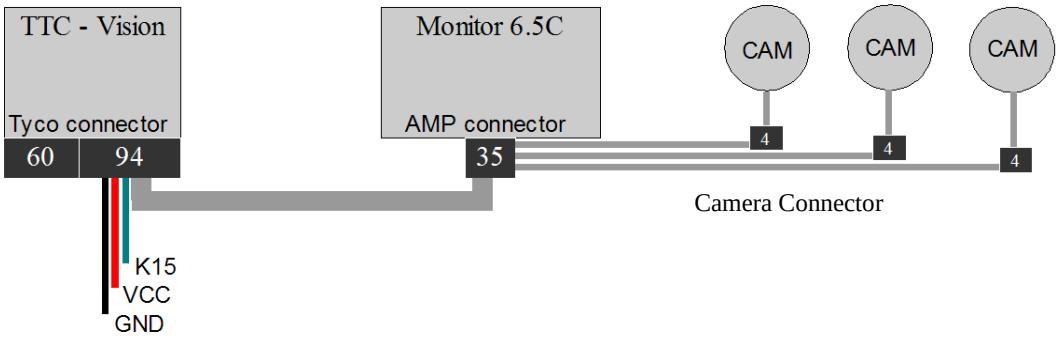


Image 1.9 Connecting scheme using the standard cabling.

Regarding the use of Vision, we strongly suggest reading the corresponding user manual and gaining basic knowledge. The user manual contains a lot of important information which will make system setup easier. In order to run the system, Vision needs a DC power supply (9-36V) and the K15 input (On/Off switch) must be connected with V_{CC}. All cables can be identified by checking the user manual or the connector pinning included in this chapter. The most important cables of the standard cabling are Vcc, GND and K15. Like all other wires, these are printed with the proper identification number.

K15 = 252
V_{CC} = 201
GND = 273

Next an application is needed to generate a visualization and activate the composite camera. The system can be programmed in several ways. The programmer can use CoDeSys, Matlab or C to code its application. However most programmers prefer CoDeSys which comes with an adapted runtime system and allows very user-friendly access to all functionalities.

Connectors and pinning

Monitor 6.5C – 35-pin AMPSEAL connector

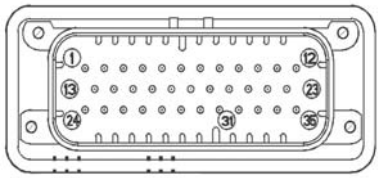


Image 1.10 – 35-pin AMPSEAL plug rear view

Pin	Cable	mm²	Length	Signal name	End connector
1	shielded video cable 75 Ω	0.75	40cm	Vcc CAM1	Orlaco Connector Pin 3
2	shielded video cable 75 Ω	0.75 shield	40cm	GND + Video GND CAM1	Orlaco Connector Pin 4, 2
3	shielded video cable 75 Ω	0.75	40cm	Vcc CAM2	Orlaco Connector Pin 3
8	shielded video cable 75 Ω	0.75	40cm	Vcc CAM3	Orlaco Connector Pin 3
9	shielded video cable 75 Ω	0.75 shield	40cm	GND + Video GND CAM3	Orlaco Connector Pin 4, 2
10			40cm	TOUCH GND	to DSUB9-8 male Pin 5
13	shielded video cable 75 Ω	0.75	40cm	Signal CAM2	Orlaco Connector Pin 1
14	unshielded twisted pair	0.25	2.5m	RS485-	94-pin TYCO Pin 219
15	shielded video cable 75 Ω	0.75 shield	40cm	GND + Video GND CAM2	Orlaco Connector Pin 4, 2
16		1.5	2.5m	BAT+	94-pin TYCO Pin 203
17	shielded twisted pair 4, e.g. CAT5	0.25	2.5m	LVDS_CLK+	94-pin TYCO Pin 265
18	shielded twisted pair 3, e.g. CAT5	0.25	2.5m	LVDS_TX2+	94-pin TYCO Pin 266
19	shielded twisted pair 2, e.g. CAT5	0.25	2.5m	LVDS_TX1+	94-pin TYCO Pin 268
20	shielded twisted pair 1, e.g. CAT5	0.25	2.5m	LVDS_TX0+	94-pin TYCO Pin 269
21		0.25	40cm	TOUCH_RXD	to DSUB9-8 male Pin 2
22		0.5	2.5m	GND	94-pin TYCO Pin 256
23		1.5	2.5m	GND	94-pin TYCO Pin 229
24	shielded video cable 75 Ω	0.75	40cm	Signal CAM3	Orlaco Connector Pin 1
25	shielded video cable 75 Ω	0.75	40cm	Signal CAM1	Orlaco Connector Pin 1
26	unshielded twisted pair	0.25	2.5m	RS485+	94-pin TYCO Pin 241
27		0.25	2.5m	GND RS485	94-pin TYCO Pin 218
28		1.5	2.5m	BAT+	94-pin TYCO Pin 202
29	shielded twisted pair 4, e.g. CAT5	0.25	2.5m	LVDS_CLK-	94-pin TYCO Pin 287
30	shielded twisted pair 3, e.g. CAT5	0.25	2.5m	LVDS_TX2-	94-pin TYCO Pin 288
31	shielded twisted pair 2, e.g. CAT5	0.25	2.5m	LVDS_TX1-	94-pin TYCO Pin 290
32	shielded twisted pair 1, e.g. CAT5	0.25	2.5m	LVDS_TX0-	94-pin TYCO Pin 291
33		0.25	40cm	TOUCH_TXD	to DSUB9-8 male Pin 3
34	shielded twisted pair, e.g. CAT5	shield	2.5m	GND LVDS	94-pin TYCO Pin 289
35	shielded twisted pair, e.g. CAT5	shield	2.5m	GND LVDS	94-pin TYCO Pin 267

Table 1.5: 35-pin AMPSEAL: pinning, cabling information, minimal cable diameter, maximal length, signal name, connector

Vision – 94-pin TYCO connector

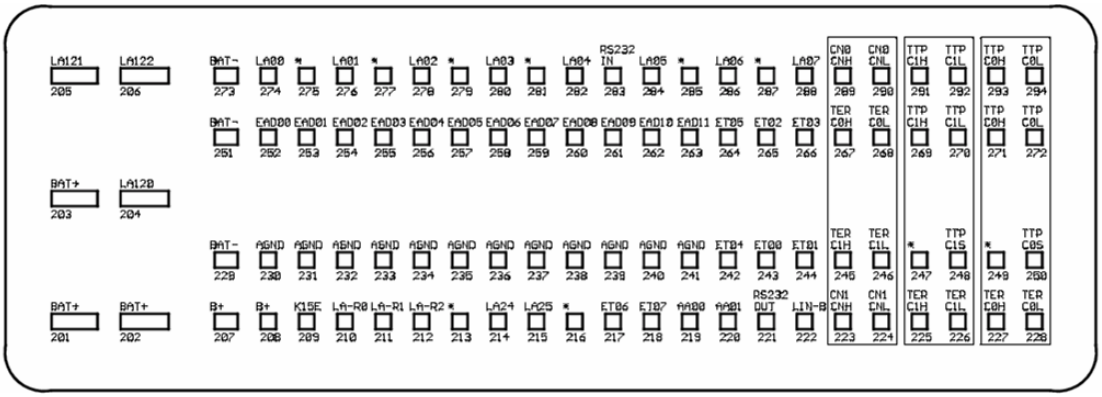


Image 1.11: 94 TYCO plug rear view

Group	Pin	Cable	mm²	Length	Signal name	End connector
Supply	252	red	0.75	1.5m	K-15	free cable
	201	red	2.5	1.5m	BAT+	free cable
	202		1.5	2.5m	BAT+	to 35-pin AMP Pin 28
	203		1.5	2.5m	B+	to 35-pin AMP Pin 16
	273	black	1.5	1.5m	BAT-	free cable
	251	black	1.5	1.5m	BAT-	free cable
	229		1.5	2.5m	BAT-	to 35-pin AMP Pin 23
	253		0.5		GND	bridge to 94-pin Pin 275
	256		0.5	2.5m	GND	to 35-pin AMP Pin 22
	275		0.5		RTBATT_ON	bridge to 94-pin Pin 253
N.C.	204				not connected	
	205				not connected	
	206				not connected	
	208				not connected	

TTP interface	209				TTP C1 S	
	210				TTP C1 L	
	211				TTP C1 H	
	212				TTP TC0 H	
	213				TTP C0 H	
	214				TTP C0 L	
	215				TTP TC0 L	
	230				GND	
	231				TTP TC1 L	
	232				TTP C1 L	
	233				TTP C1 H	
	234				TTP TC1 H	
	235				TTP C0 H	
	236				TTP C0 L	
	237				TTP C0 S	
	238				GND	
Analogue video interface	227				AN Hor - Sync	
	249				AN Ver - Sync	
	292				AN Video - Clk	
	270				AN Video - Clk invertet	
	294				AN CH A	
	293				GND	
	272				AN CH B	
	271				GND	
	250				AN CH C	
	228				GND	
Digital video interface	265	Networkcable Twisted Pair CAT 5 with shield	orange/white	2.5m	DV pos clk	to 35-pin AMP Pin 17
	287		orange	2.5m	DV neg clk	to 35-pin AMP Pin 29
	269		brown/white	2.5m	DV pos data 0	to 35-pin AMP Pin 20
	291		brown	2.5m	DV neg data 0	to 35-pin AMP Pin 32
	268		green/white	2.5m	DV pos data 1	to 35-pin AMP Pin 19
	290		green	2.5m	DV neg data 1	to 35-pin AMP Pin 31
	266		blue	2.5m	DV pos data 2	to 35-pin AMP Pin 18
	288		blue/white	2.5m	DV neg data 2	to 35-pin AMP Pin 30
	267		shield	2.5m	DV GND	to 35-pin AMP Pin 35
	289		shield	2.5m	DV GND	to 35-pin AMP Pin 34

CAN	222	CAN Cable	white	1.5m	CAN1-L	to DSUB9-1 female Pin 2
	244		red	1.5m	CAN1-H	to DSUB9-1 female Pin 7
	226		black	1.5m	CAN1 GND	to DSUB9-1 female Pin 3
	223		black	1.5m	CAN1-shield	to DSUB9-1 female Pin 5
	224	CAN Cable	white	1.5m	CAN0-L	to DSUB9-2 female Pin 2
	246		red	1.5m	CAN0-H	to DSUB9-2 female Pin 7
	248		black	1.5m	CAN0 GND	to DSUB9-2 female Pin 3
	245		black	1.5m	CAN0-shield	to DSUB9-2 female Pin 5
RS485	241	4x0.25 twisted pair	0.25	2.5m	RS485 A - A	to 35-pin AMP Pin 26
	219		0.25	2.5m	RS485 A - B	to 35-pin AMP Pin 14
	242		0.25		RS485 A - shield	
	218		0.25	2.5m	RS485 A - GND	to 35-pin AMP Pin 27
	239	4x0.25 twisted pair	0.25	1.5m	RS485 B - A	to DSUB9-4 female Pin 2
	217		0.25	1.5m	RS485 B - B	to DSUB9-4 female Pin 7
	216		0.25	1.5m	RS485 B - GND	to DSUB9-4 female Pin 3
	240		0.25	1.5m	RS485 B - shield	to DSUB9-4 female Pin 5
LIN	221		0.5	1.5m	LIN supply	free cable
	243		0.5	1.5m	LIN data	free cable
	220		0.5	1.5m	LIN GND	free cable
Ethernet	257	Networkcable TwistedPair CAT 5	green	1.5m	ETH - IN	to RJ45 female Pin 6
	279		green/white	1.5m	ETH + IN	to RJ45 female Pin 3
	258		orange	1.5m	ETH - OUT	to RJ45 female Pin 2
	280		orange/white	1.5m	ETH + OUT	to RJ45 female Pin 1
Modem	282	9x0.22 or 9x0.25 Cable	0.22 or 0.25	1.5m	CD	to DSUB9-5 male Pin 1
	283		0.22 or 0.25	1.5m	RX	to DSUB9-5 male Pin 2
	284		0.22 or 0.25	1.5m	TX	to DSUB9-5 male Pin 3
	285		0.22 or 0.25	1.5m	DTR	to DSUB9-5 male Pin 4
	260		0.22 or 0.25	1.5m	DSR	to DSUB9-5 male Pin 6
	261		0.22 or 0.25	1.5m	RTS	to DSUB9-5 male Pin 7
	262		0.22 or 0.25	1.5m	CTS	to DSUB9-5 male Pin 8
	263		0.22 or 0.25	1.5m	RI	to DSUB9-5 male Pin 9
	264		0.22 or 0.25	1.5m	GND	to DSUB9-5 male Pin 5

Ibutton	281		0.5	1.5m	SIG	free cable
	259		0.5	1.5m	GND	free cable
Sensor	225		0.5	1.5m	sensor supply 5V	free cable
	247		0.5	1.5m	GND	free cable
Temp.	276		0.5	1.5m	TmpA	free cable
	254		0.5	1.5m	GND	free cable
	277		0.5	1.5m	TmpB	free cable
	255		0.5	1.5m	GND	free cable

Table 1.6: 94-pin TYCO: pinning, cabling information, minimal cable diameter, maximal length, signal name, connector

Composite camera – 4-pin Camera connector

P/N 99-2010-00-04
Type of connector:
Binder Serie 581

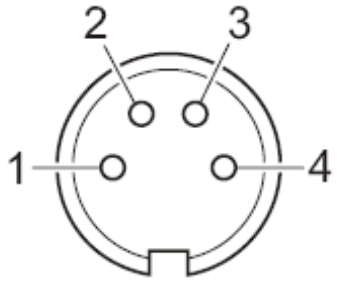


Image 1.12 Camera Connector (front view of the female connector, rear view of the male connector):

Pin	Name	Signal name
1	Coax core	Video signal
2	Coax safeguard	Video ground
3	Red	12V/DC
4	White	Feedground

Table 1.7: 94-pin TYCO: pinning, cabling information, minimal cable diameter, maximal length, signal name, connector

Maintenance and cleaning

Modifications and repairs are forbidden; mounting and maintenance must be carried out in accordance with TTControl.
During common use is avoid scratching, using abrasive pads, scouring powders, or solvents such as alcohol, benzene, or paint thinner.
The display can be cleaned with an LCD cleaning solution found in many stores or a mild dishwashing detergent. Always clean Monitor 6.5C with a soft, damp cloth.

Safety instructions

The system is not designed to display safety-critical visualizations and shouldn't be used to influence such applications on the Vision system. Regular inspections of the Display system and the connected cameras are strongly suggested. Keep the cameras clean to maintain optimal sight and minimize the risk of overlooking obstacles.

Failures and solutions

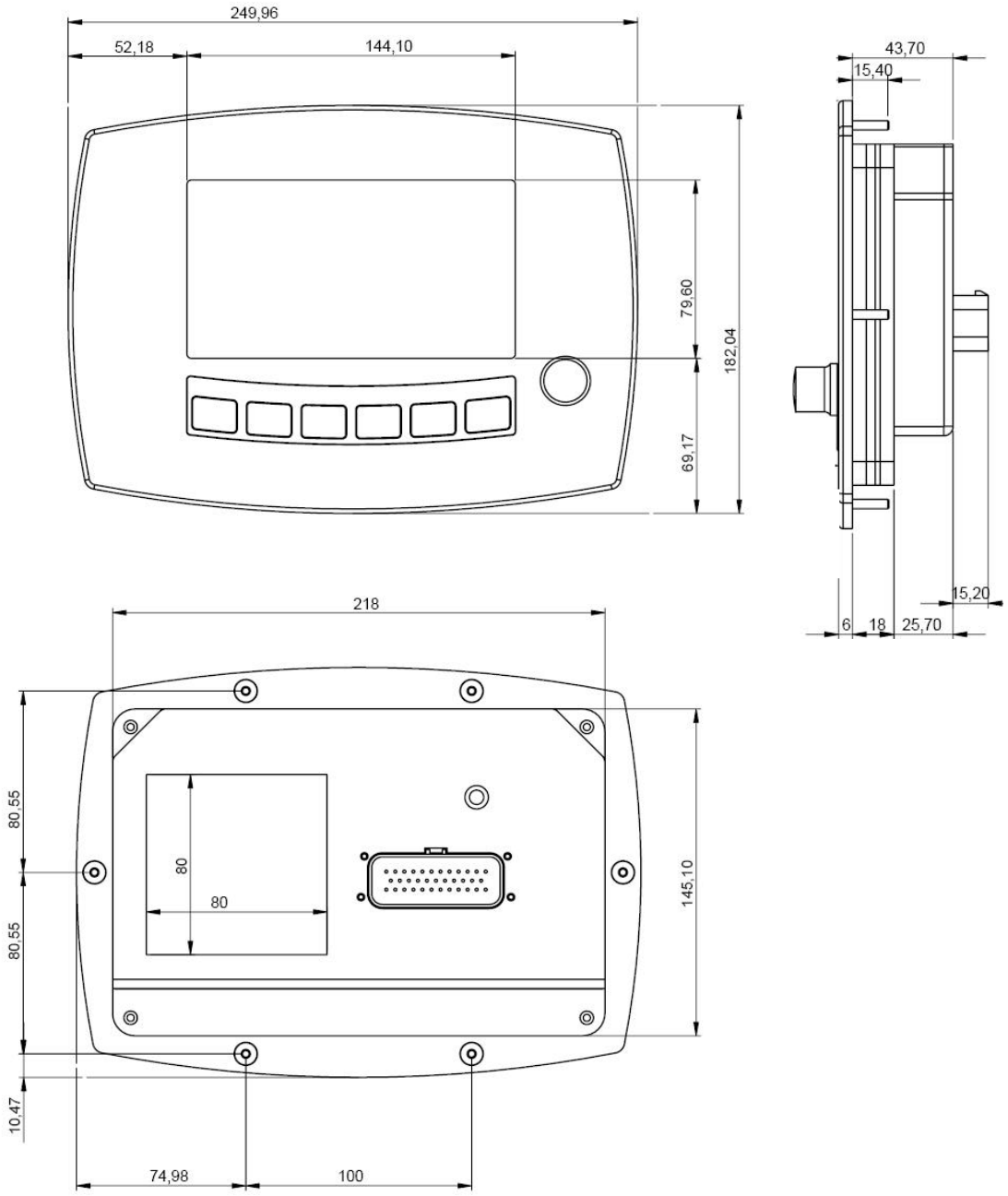
The following tables contain information about the different possible failures that could occur in each module's subsystem.

Nr.:	Failure description	Problem solution
1	No image and no backlight after start up	Check connection
2.a	No image but backlight works	Check if Vision is working
2.b	No image but backlight works, Vision is running	Check the connectors contact of the cable to the TTC-Vision and test the feedthrough
2.c	No image but backlight works, Vision is running, cable is fine	Contact TTControl: the unit might need to be sent back
3.a	Cameras connected but nothing happens when pressing the proper key	Check the contacts of the connecting cable and test the feedthrough
3.b	Cameras connected but nothing happens when pressing the proper key, cable works fine	Try a second camera or check the composite video signal
4	Encoder doesn't work	Check the RS485 connection
4.a	Keypad doesn't work	Check the RS485 connection
4.b	Encoder and keypad fail, RS485 connection works	Contact TTControl

Table 1.8: 94-pin TYCO: pinning, cabling information, minimal cable diameter, maximal length, signal name, connector

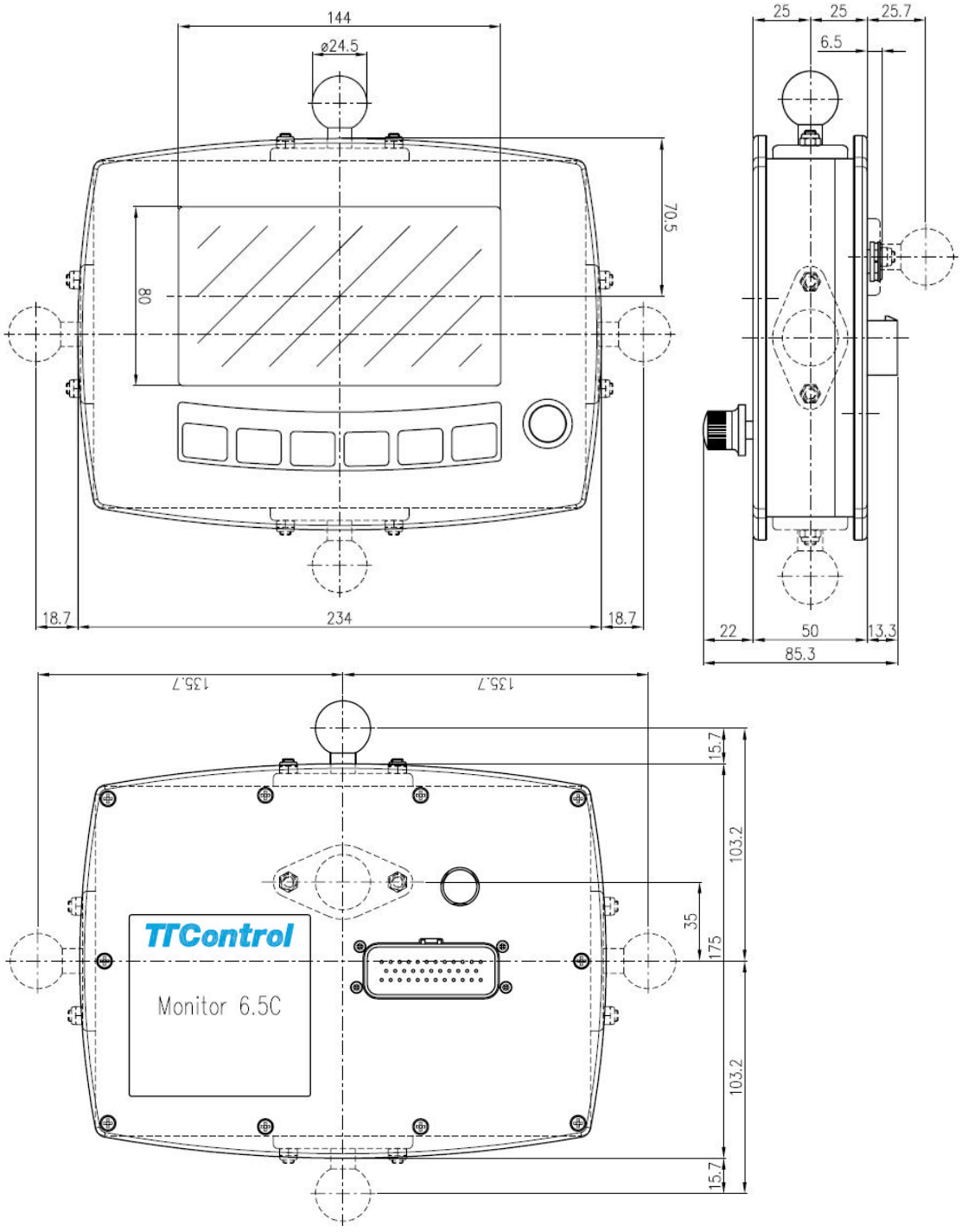
Mechanical drawings

Panel mount version



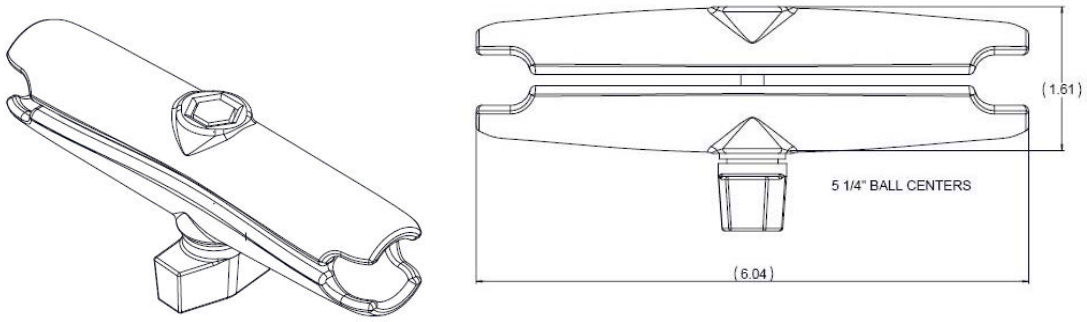
Images 1.13 Mechanical drawings and dimensions of the panel mount Monitor 6.5C

Cabin mount version V3

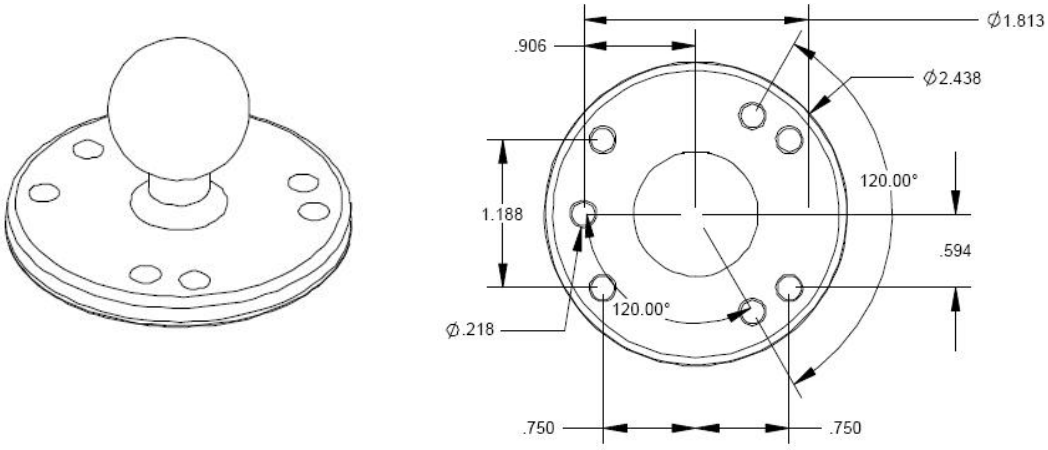


Images 1.14 Mechanical drawings and dimensions of the cabin mount Monitor 6.5C

RAM ball stand



Images 1.15 Mechanical drawings and dimensions of RAM ball stand



Images 1.16 Mechanical drawings and dimensions of the RAM ball socket

Certifications

All TTControl products are subjected to regular and strict quality inspections. The environmental tests when applied to the Monitor 6.5C module show results from an independent test center.

Environmental tests

Norm reference	Description	Test parameters	Result
EN 60068-2-1	Operation temperature test	-20°C to +70°C	PASS
EN 60068-2-1	Storage temperature test	-40°C to +70°C	PASS
EN 60068-2-14Nb	Temperature cycle test	-20°C to +70°C, 48h	PASS
EN 60068-2-30	Damp heat test, cycle	+25°C to +55°C, 95% humid., 2 cycles	PASS

Table 1.9: Temperature resistance tests

Norm reference	Description	Test parameters	Result
EN 60068-2-64	Vibration test	random, 10-2000Hz, eff.acc.8,1g, 3h per axis	PASS
EN 60068-2-27	Shock test	half-sine, 30g, 6ms, 10 shocks per axis and direction	PASS
EN 60068-2-32	Free fall test (with packaging)	100 cm drop height, 6 drop tests per side	PASS

Table 1.10: Vibration - shock - free fall and bump tests

PASS The device under testing meets the requirements of the standard
PASS[1)] An external load dump protection device was used for this test

Electromagnetic compatibility tests

According to the requirement standards ISO 13766:1999 and 7637-3:1995

Norm. References Chapter	Measurement range	Term	Type	Result
CISPR 25	30 MHz – 1000MHz	Radiated emissions	Broadband	PASS
			Narrowband	PASS

Table 1.11: Emission measurement: ISO 13766:1999

Norm. References	Test specification	Term	Result
EN 61000-4-2	± 2kV, ± 4kV	Electrostatic discharges	PASS
ISO 11452-2	30V/m 80MHz – 1000Mhz AM:1kHz 80%	Radio frequency electromagnetic fields (ALSE)	PASS
ISO 11425-5	60 V/m 20 MHz - 80 MHz AM: 1kHz 80%	Radio-frequency electromagnetic fields - stripline	PASS
ISO 7637-2	U_S = -50 V, 50 Ω 5000 pulses	Test pulse 1a	PASS
	U_S = 25 V, 2 Ω 5000 pulses	Test pulse 2	PASS
	U_S = -35 V, +35 V 50 Ω, 1 hour each	Test pulses 3a and 3b	PASS
	U_S = -5 V, Ua = -4 V, 0.02 Ω 1 pulse	Test pulse 4	PASS
	U_S = 70 V, 1 Ω 1 pulse	Test pulse 5	PASS[1)]

Table 1.12: Susceptibility / Immunity test 13766:1999

Additional tests

Norm. References	Test specification	Term	Result
EN 61000-4-2	± 4 kV, ± 6 kV	Electrostatic discharges	PASS
ISO 11425-5	100 V/m 20 MHz - 80 MHz AM: 1kHz 80%	Radio-frequency electromagnetic fields - stripline	PASS
ISO 7637-2	U_S = 173 V, 2 Ω 1 pulse	Test pulse 5	PASS[1)]
ISO 7637-3	U_s = -80 V, +80 V 50 Ω, 10 min. each	Test pulses 3a and 3b	PASS

Table 1.13: Additional electromagnetic compatibility tests

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