

## **Appendix**

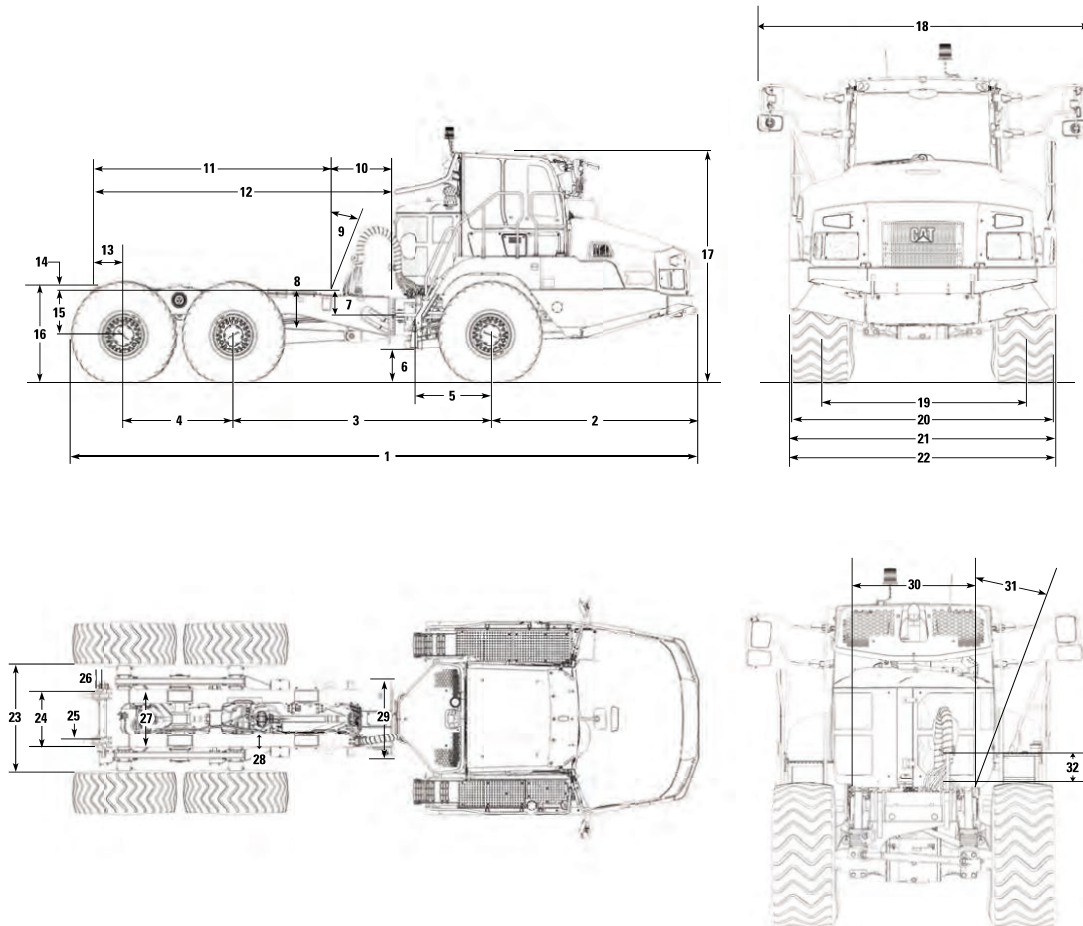
- I. Cat 725 Truck Specs
- II. Cat 730 Truck Specs
- III. Cat 740 Truck Specs
- IV. Hydraulic Manifold Diagram
- V. Control Screen Wiring Diagram
- VI. Deep Sea Screen Features and Pin Outs
- VII. Nitro Monitor Wiring Diagram
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# I. Cat 725 Dimensions

## 725 Articulated Truck Bare Chassis Specifications

### Dimensions

All dimensions are approximate.



## 725 Articulated Truck Bare Chassis Specifications

<b>Dimensions</b>		
1 Overall Length	9694 mm	381.65 in
2 Front Axle to Bumper	3210 mm	126.38 in
3 Front Axle to Center Axle	3979 mm	156.65 in
4 Center Axle to Rear Axle	1700 mm	66.93 in
5 Articulation Joint to Front Axle	1210 mm	47.64 in
6 Clearance	539 mm	21.22 in
7 Pivot Pin to Frame Bottom	363 mm	14.29 in
8 Frame Height Rear	449 mm	17.68 in
9 Front Body Angle		22 degrees
10 Body Pivot Clearance	851 mm	33.50 in
11 Body Clearance	3678 mm	144.80 in
12 Body Guides	4408 mm	173.54 in
13 Rear Axle to Pivot Pin (horizontal)	421 mm	16.57 in
14 Pivot Pin to Top of Frame Rail	90 mm	3.54 in
15 Rear Axle to Pivot Pin (vertical)	635 mm	25.00 in
16 Top of Frame Rail	1506 mm	59.29 in
17 Top of Cab	3508 mm	138.11 in
18 Mirror Width	3676 mm	144.72 in
19 Track Width	2275 mm	89.57 in
20 Fender Width	2877 mm	113.27 in
21 Over Free Width of Tire	2950 mm	116.14 in
22 Max Unladen Over Tire Bulge	2950 mm	116.14 in
23 Tire Clearance	1629 mm	64.13 in
24 Pivot Casting Width	833 mm	32.80 in
25 Pivot Bearing to Rear Frame	93 mm	3.66 in
26 Pivot Bearing Width	134 mm	5.28 in
27 Frame Width (rear)	896 mm	35.28 in
28 Beam Width	196 mm	7.72 in
29 Frame Width (front)	1096 mm	43.15 in
30 Body Width	858 mm	33.78 in
31 Truck Body Angle		45 degrees
32 Max Tire Clearance	373 mm	14.69 in

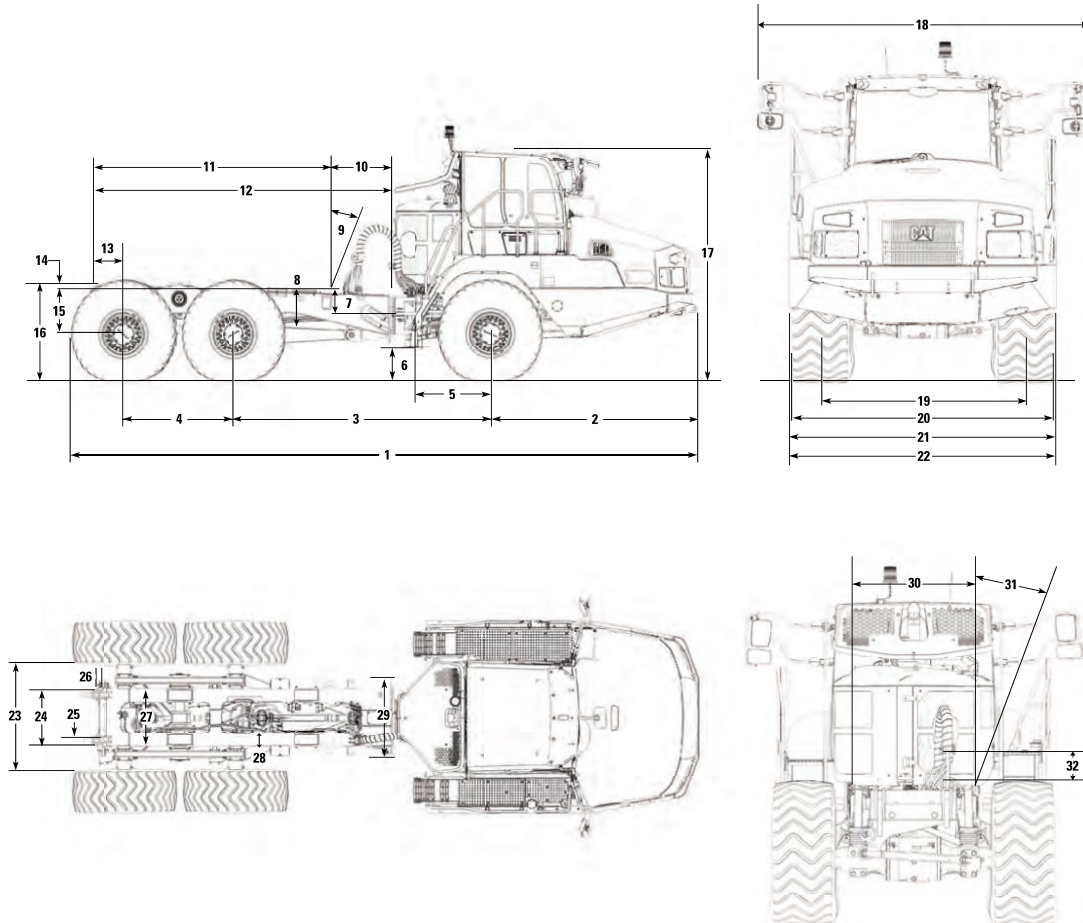
*\*\* These dimensions may vary based on tire size, pressure and load. All dimensions are for reference only and may change for different machine configurations.*

## II. Cat 730 Dimensions

### 730 Articulated Truck Bare Chassis Specifications

#### Dimensions

All dimensions are approximate.



**730 Articulated Truck Bare Chassis Specifications**

<b>Dimensions</b>	<b>SWB</b>		<b>LWB</b>	
1 Overall Length	9694 mm	381.65 in	11 180 mm	440.16 in
2 Front Axle to Bumper	3210 mm	126.38 in	3210 mm	126.38 in
3 Front Axle to Center Axle	3979 mm	156.65 in	5475 mm	215.16 in
4 Center Axle to Rear Axle	1700 mm	66.93 in	1700 mm	66.93 in
5 Articulation Joint to Front Axle	1210 mm	47.64 in	1210 mm	47.64 in
6 Clearance	545 mm	21.48 in	548 mm	21.6 in
7 Pivot Pin to Frame Bottom	363 mm	14.29 in	-	-
8 Frame Height Rear	311 mm	12.24 in	-	-
9 Front Body Angle		22 degrees		22 degrees
10 Body Pivot Clearance	858 mm	33.72 in	858 mm	33.72 in
11 Body Clearance	3678 mm	144.80 in	5144 mm	202.56 in
12 Body Guides	3566 mm	140.4 in	4287 mm	168.72 in
13 Rear Axle to Pivot Pin (horizontal)	421 mm	16.2 in	422 mm	16.56 in
14 Pivot Pin to Top of Frame Rail	90 mm	3.54 in	90 mm	3.54 in
15 Rear Axle to Pivot Pin (vertical)	620 mm	24.36 in	638 mm	25.08 in
16 Top of Frame Rail	1491 mm	58.68 in	1516 mm	59.64 in
17 Top of Cab	3508 mm	138.11 in	3508 mm	138.11 in
18 Mirror Width	3676 mm	144.72 in	3676 mm	144.72 in
19 Track Width	2275 mm	89.57 in	2275 mm	89.57 in
20 Over Free Width of Tire	2877 mm	113.27 in	2877 mm	113.27 in
21 Fender Width	2950 mm	116.14 in	2950 mm	116.14 in
22 Max Unladen Over Tire Bulge	2950 mm	116.14 in	2950 mm	116.14 in
23 Tire Clearance	1629 mm	64.13 in	1629 mm	64.13 in
24 Pivot Casting Width	833 mm	32.80 in	833 mm	32.80 in
25 Pivot Bearing to Rear Frame	93 mm	3.66 in	93 mm	3.66 in
26 Pivot Bearing Width	134 mm	5.28 in	134 mm	5.28 in
27 Frame Width (rear)	910 mm	35.88 in	910 mm	35.88 in
28 Beam Width	196 mm	7.72 in	196 mm	7.72 in
29 Frame Width	896 mm	35.28 in	896 mm	35.28 in
30 Body Width	2914 mm	114.72 in	-	-
31 Truck Body Angle		45 degrees		45 degrees
32 Tire Height to Chassis	98 mm	3.84 in	98 mm	3.84 in

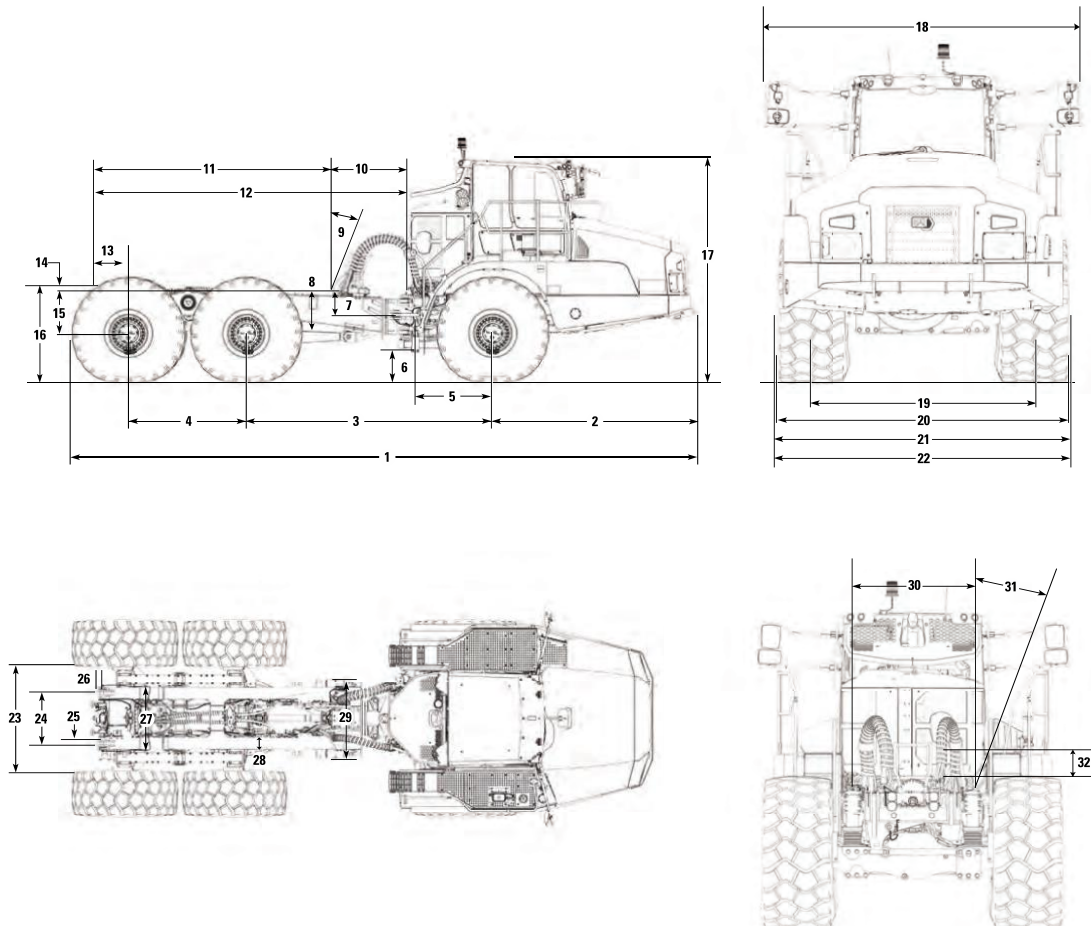
\*\* These dimensions may vary based on tire size, pressure and load. All dimensions are for reference only and may change for different machine configurations.

### III. Cat 740 Dimensions

#### 740 GC Articulated Truck Bare Chassis Specifications

##### Dimensions

All dimensions are approximate.

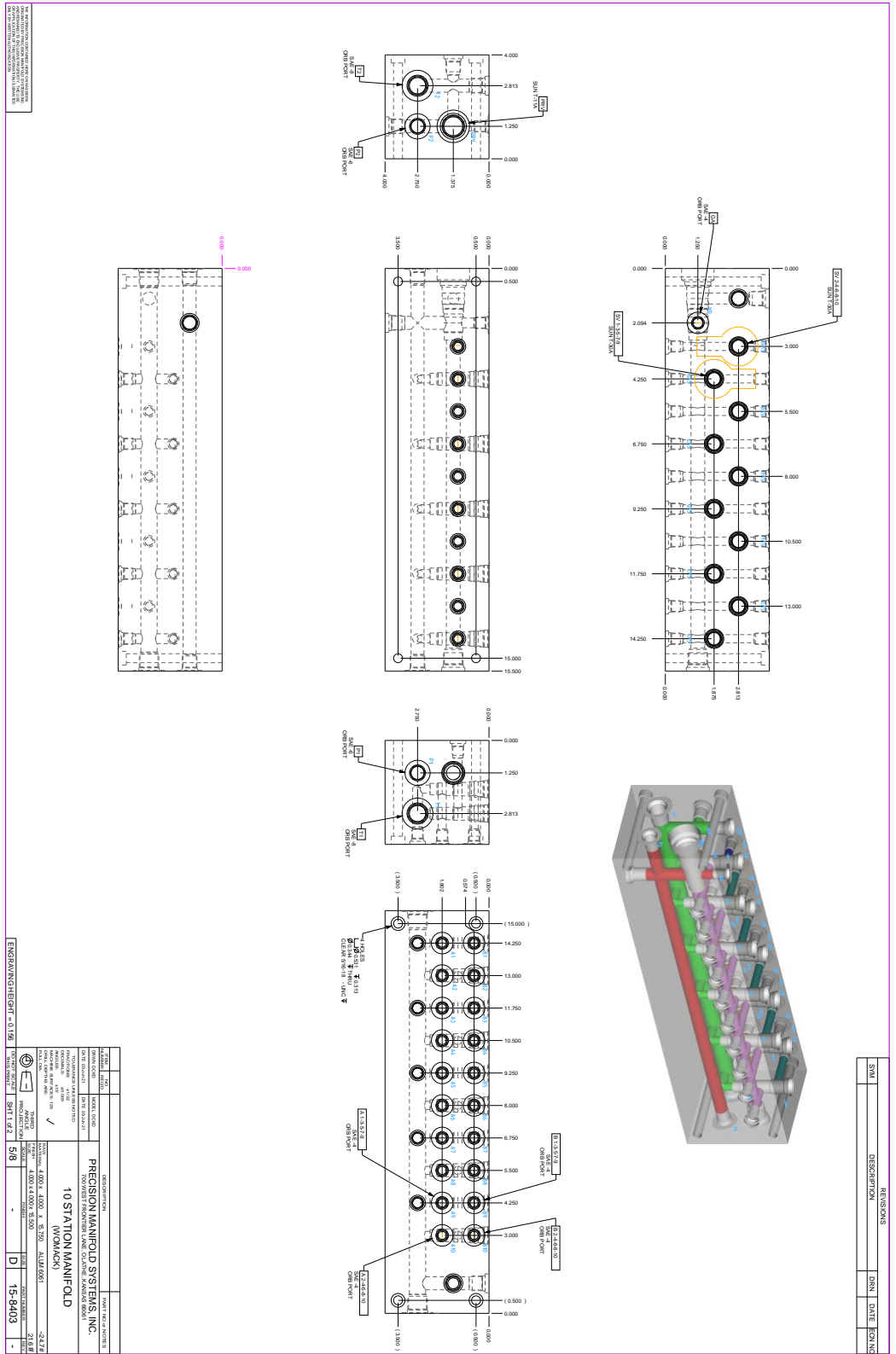


## 740 GC Articulated Truck Bare Chassis Specifications

Dimensions		
1 Overall Length	10 439 mm	410.98 in
2 Front Axle to Bumper	3418 mm	134.57 in
3 Front Axle to Center Axle	4126 mm	162.44 in
4 Center Axle to Rear Axle	1966 mm	77.40 in
5 Articulation Joint to Front Axle	1450 mm	57.09 in
6 Clearance	588 mm	23.15 in
7 Pivot Pin to Frame Bottom	301 mm	11.85 in
8 Frame Height Rear	391 mm	15.39 in
9 Front Body Angle		22 degrees
10 Body Pivot Clearance	1045 mm	41.14 in
11 Body Clearance	3579 mm	140.91 in
12 Body Guides	3479 mm	136.97 in
13 Rear Axle to Pivot Pin (horizontal)	383 mm	15.08 in
14 Pivot Pin to Top of Frame Rail	104 mm	4.09 in
15 Rear Axle to Pivot Pin (vertical)	665 mm	26.18 in
16 Top of Frame Rail	1662 mm	65.43 in
17 Top of Cab	3757 mm	147.91 in
18 Mirror Width	3801 mm	149.65 in
19 Track Width	2687 mm	105.79 in
20 Over Free Width of Tire	3438 mm	135.35 in
21 Fender Width	3370 mm	132.68 in
22 Max Unladen Over Tire Bulge	3500 mm	137.80 in
23 Tire Clearance	1910 mm	75.20 in
24 Pivot Casting Width	1031 mm	40.59 in
25 Pivot Bearing to Rear Frame	108 mm	4.25 in
26 Pivot Bearing Width	134 mm	5.28 in
27 Frame Width (rear)	1110 mm	43.70 in
28 Beam Width	206 mm	8.11 in
29 Frame Width	1096 mm	43.15 in
30 Body Width	3422 mm	134.72 in
31 Truck Body Angle		45 degrees
32 Tire Height to Chassis	41 mm	1.16 in

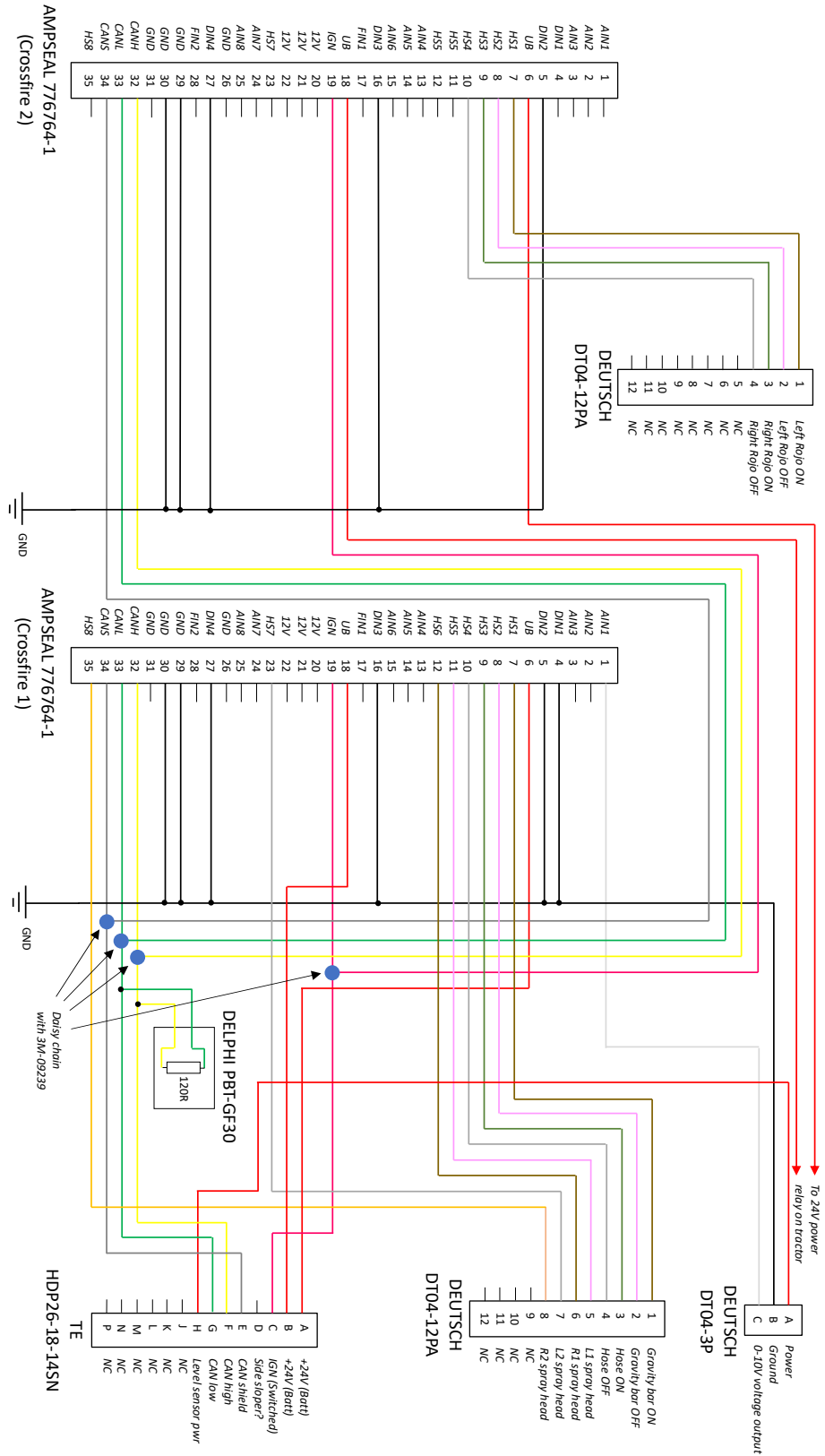
*\*\* These dimensions may vary based on tire size, pressure and load. All dimensions are for reference only and may change for different machine configurations.*

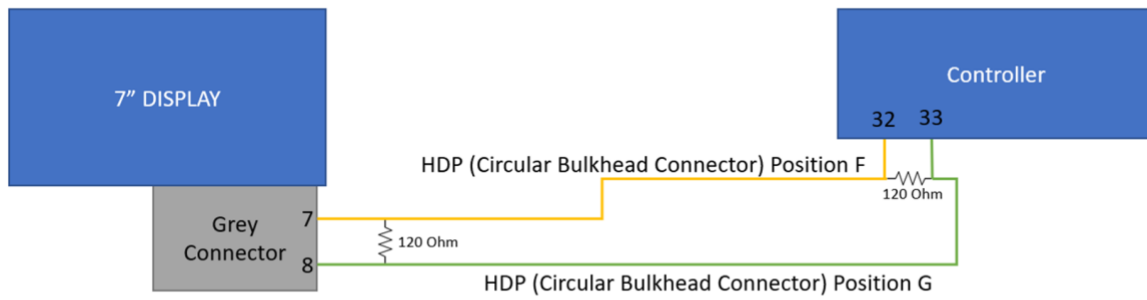
# IV. Hydraulic Manifold



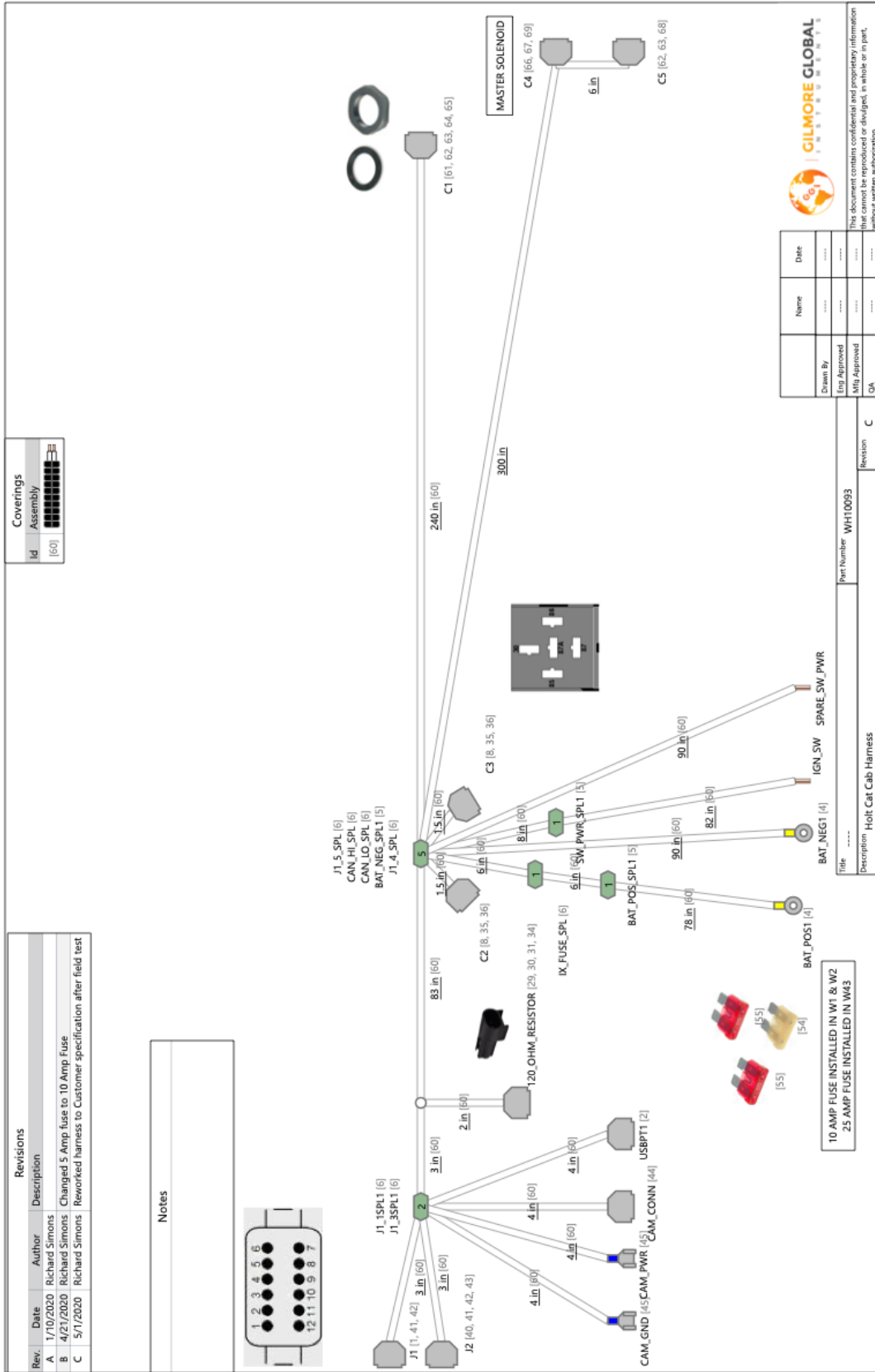


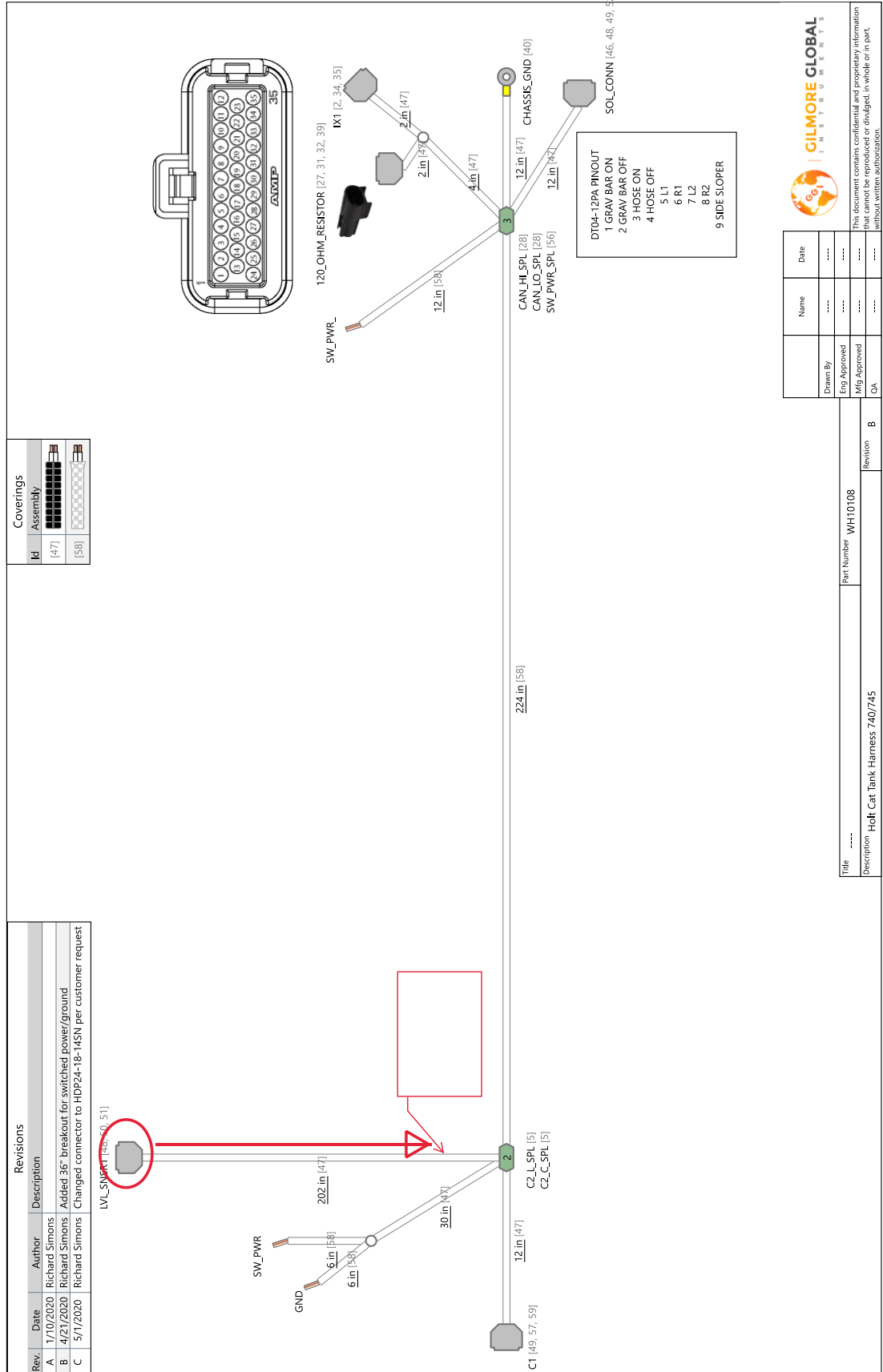
# V. Control Screen Wiring Diagram





The yellow wire connects at position F on the HDP connector between the two harnesses, whereas the green wire is located at position G.





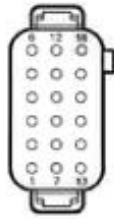
Name	Date
Drawn By	.....
Eng. Approved	.....
Mfg. Approved	.....
CHK	.....

Title	Part Number	Revision
.....	WH10108	B
Description - Holt Cat Tank Harness 740/745		

# VI. Deep Sea Screen Features and Pin Outs

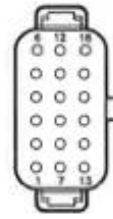


## DSEM870 PROGRAMMABLE DISPLAY FOR USE IN VEHICLES AND OFF-HIGHWAY MACHINERY



**Connector A**

PIN	DESCRIPTION
1	DGU Supply GND
2	CAN1 GND
3	CAN2 GND
4	No connection
5	Camera 1 GND
6	Camera 2 GND
7	SOU Supply -VCC
8	CAN1 H
9	CAN1 B
10	No connection
11	Camera 1 signal
12	Camera 2 signal
13	Ignition +VE (12)
14	CAN1 L
15	CAN2 L
16	No connection
17	No connection
18	No connection



**Connector C**

PIN	DESCRIPTION	REF
1	Output supply +VE	
2	OUT H, L	Q2001
3	OUT H, L	Q2002
4	OUT H, L	Q2003
5	OUT H, L	Q2004
6	VREF -	
7	Output supply GND	
8	No connection	
9	No connection	
10	No connection	
11	No connection	
12	Output supply GND	
13	Aut 12 +VCC Output	
14	AIN_0M H, L, FREQ	IC2001
15	AIN_0M H, L, FREQ	IC2002
16	AIN_0M H, L, FREQ	IC2003
17	AIN_0M H, L, FREQ	IC2004
18	VREF GND	



**Ethernet**  
MT12 17 coded - 4 pin female

Pin - 01	TX+
Pin - 02	TX-
Pin - 03	RX+
Pin - 04	RX-



**USB Host**  
MT12 17 coded - 5 pin female

Pin - 01	+5V (D)
Pin - 02	Data +
Pin - 03	Data -
Pin - 04	D1
Pin - 05	GND

**Abbreviations**  
OUT H/M, L  
OUT H  
AIN  
DM H, L, FREQ  
A GND

Output can be configured as a PWM, PPM, digital high-side or digital low-side  
Output is digital high  
Output can be configured as a digital high-side or digital low-side  
Input can be configured to accept signals from positive digital, negative digital, 0 V to 12 V, 4 mA to 20 mA, analogue or resistive  
Input can be configured to accept signals from positive digital, negative digital or frequency  
Consult literature for the analog input channels



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## DSE M870

Camera		Connector A	
Analogue video input (supported video standards: PAL & NTSC)	2	5, 6, 11, 12	
CAN Interfaces		Connector A	
Number of CAN ports	2	Pin 2, 3, 8, 9, 14, 15	
Supported protocols	J1939		
	CAN open		
	Raw CAN		
Supported programmable baud rates	50 kbit/s, 125 kbit/s, 250 kbit/s, 500 kbit/s, 800 Mbit/s, 1 Mbit/s		
Ethernet Interface		M12, 4 pole	
Number of Ethernet ports	1	D-coded 4 pole socket	
Supported data rates	10/100 Mbit/s		
Supported protocols	Modbus TCP		
	CODESYS 3.5		
USB Interface		M12, 5 pole	
Number of USB host ports	1	B-coded, 5 pole socket	
Supported USB version	2		
Speeds supported	Full speed (12 Mbit/s)		
Device class supported	08 (Mass Storage)		
Supported filing system	FAT32		
Processor			
Technexion Freescale iMX6-SOLO Microcontroller	ARM A9		
	800 MHz		
Memory			
Flash	2 GB		
RAM	512 MB		
Software		Version	
CODESYS 3.5 (M870-D1 / M870-D2 / M870-D3)		SP12 Patch 0	
Qt (M870-D4)		V 5.15	
LED Status			
Colour	Description	Operation	State
None	Device not powered	N/A	Off
Green	Unit powered up, application program loaded but not running	Static	Application stopped
	Unit powered up, application program loaded and running	1 Hz flash	Application running
	Unit powered up, but no application program loaded	5 Hz flash	No application
Amber	Bootloader functioning normally, firmware present	Static	Bootloader mode
	Firmware is at start-up	Static	Firmware start-up
	Unit stopped due to a serious fault	Static	Application exception
	Bootloader is decrypting the downloaded image	1 Hz flash	Decrypting image
	Bootloader is reading an image from the USB	5 Hz flash	Reading image from USB
Red	Fatal system/hardware fault - LED may be driven directly by microcontroller error pin or firmware is in a fault condition	Static	Fatal error
	Unit running with a fault, see CODESYS error flags or web tool.	1 Hz flash	Faulty application running

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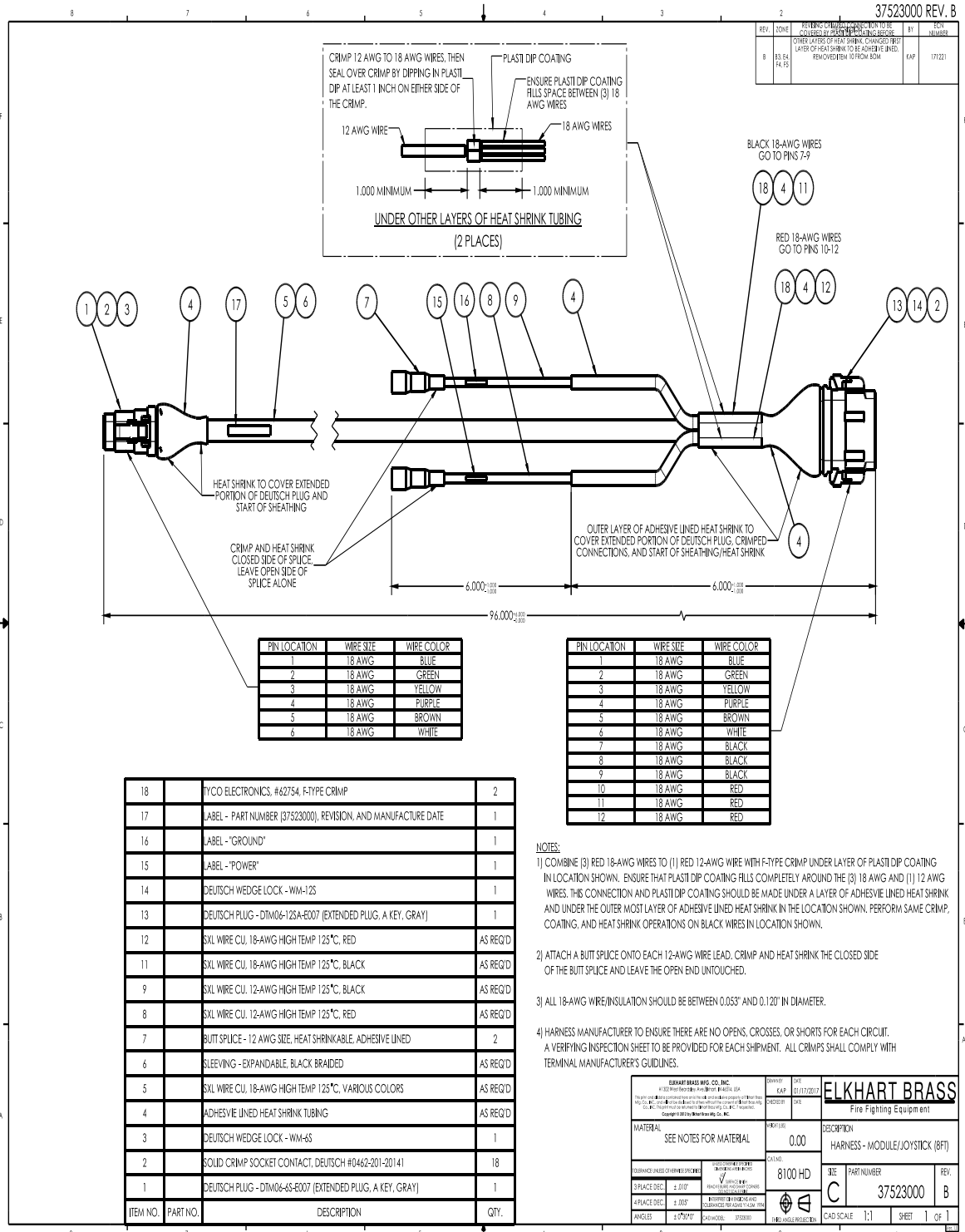


## Technical Data

CIST M870		
<b>Supply</b>		
Operating voltage	8 V DC to 32 V DC	Connector A
Unit power supply maximum current consumption, full backlight (no external loads)	< 1000 mA at 12 V and 24 V	Pin 7
Unit power supply maximum current consumption, full backlight and heater (no external loads)	< 1500 mA at 12 V and 24 V	
Unit power supply current consumption after controlled shutdown has occurred due to the ignition being turned off	< 5 mA at 24 V	
<b>Fusing</b>		
Unit power supply external protection fuse rating	3 A	Connector A
High current outputs supply input external fuse protection rating (i.e. sum of output currents from all outputs provided for by an individual supply to < external fuse rating in total)	10 A	Pin 1
<b>Housing</b>		
PC/PBT alloy plastic resin		
<b>Dimensions</b>		
140 mm x 230 mm x 80 mm (W x H x D) / 10.8" x 8.3" x 3.15" (W x H x D)		
<b>Weight</b>		
< 1 kg		
<b>Temperature</b>		
Operating temperature	-30 °C to +85 °C / -22 °F to +185 °F	
Storage temperature	-40 °C to +85 °C / -40 °F to +185 °F	
<b>Protection Rating</b>		
	IP67 (with mating connectors)	
<b>Display</b>		
Resolution, pixel	800 px x 480 px	
Colour	24 bit	
Format	7" diagonal	
Touchscreen	Capacitive touch (M870-02 / M870-04 variants)	
Mounting	Optically bonded	
Illumination	LED (lifetime > 50,000 hrs)	
<b>Connectors</b>		
Connector A	18 pin TE connectivity DT16-18SA-K004	
Connector C	18 pin TE connectivity DT16-18SC-K004	
Ethernet	M12, D-coded 4 pole socket	
USB	M12, B-coded 5 pole socket	
<b>Digital Inputs</b>		
Digital inputs configured high or low		Connector C
High level voltage threshold	> 8 V	Pin 14, 15, 16, 17
Low level voltage threshold	< 2 V	
<b>Analogue Voltage Inputs</b>		
0 V to 5 V programmable voltage range	0 V to 5 V	Connector C
0 V to 10 V programmable voltage range	0 V to 10 V	Pin 14, 15, 16, 17
0 V to 32 V programmable voltage range	0 V to 32 V	
Voltage measurement resolution	12 bits	
Voltage measurement accuracy	± 1% FSD	
Voltage measurement input resistance	≥ 30 kΩ	
Voltage measurement sampling rate	500 Hz	
FSD = Full Scale Deflection		

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# VII. Nitro Cannon Wiring Diagram





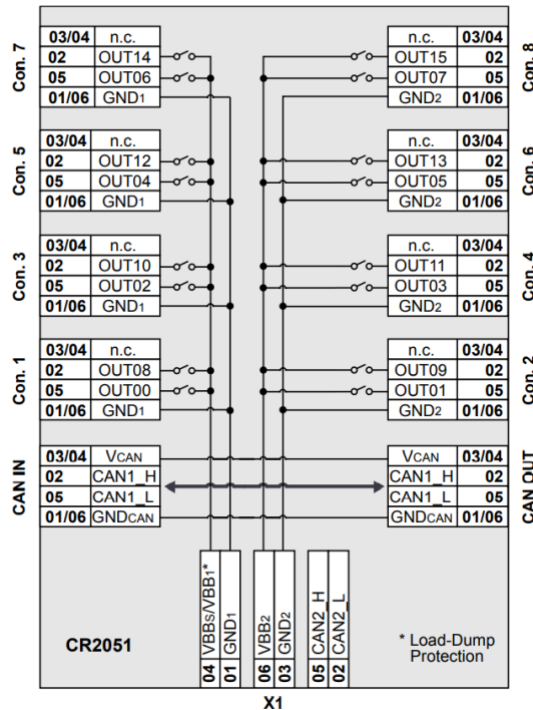
## VIII: IFM Controller Wiring Diagram

### CR2051 – GUIDE TO HOLT/GGI SOFTWARE

#### 1.1 Pin Configuration

The 16 outputs of the CR2051 are distributed between the 6-pin Deutsch connectors. There are two outputs on each connector. There are ground terminals allocated in the connector but not specifically used as we use the chassis ground directly in the wire design.

Given below is the pinout for the controller.



#### 1.2 Troubleshooting Wiring

A few scenarios that could happen in case of bad contacts from wiring:

- **CR2051 does not power on:** Check that terminals 1,4,6,3 on connector X1 are all connected to ignition power and ground appropriately. Pins 1 and 4 are the main power supply, and pins 3 and 6 provide power for specific outputs to function properly.
- **Controller does not respond to the state of the Deep Sea/ DSE M870:** Ensure that the CAN bus wires make good contact individually on both sides. Further, make sure that the CAN HI and CAN LO have a resistance of 60 Ω with all parts of the harness connected, and 120 Ω with the parts being disconnected. The resistances are near the device and thus the intermediate harness will be an open connection between CAN HI and CAN LO bus lines.
- **CR2051 LEDs light up but do not activate some or all the valves:** Make sure that there is solid connection between the valve and the designated output, and that there is a good ground on the valve's second terminal.

Additionally, verify that both the power and ground lines on X1 connector have good connections. It is possible that the CR2051 is powered by just one line, in which case the device will fail to supply power to half the outputs.






- **CR2051 seems to power on but the built-in display does not work:** Check the power lines and make sure all the ignition power and grounds are connected. Additionally check if the LEDs on the CR2051 (located just above the 4-digit display) are in any error state.

**LED Description:**






There are a total of 6 LEDs located just above the 4-digit display. From left to right these are:  
 LED [Power](green), LED [Mode](green), Application LEDs(green), LED [Lock] (green), LED [Diagnostics] (red)

Only LED [Power] and LED [Diagnostics] are used to convey the system status and errors:

The green LED [PWR] signals the system status.

LED colour	Display	Description
Off	Permanently off 	No operating voltage
Green	briefly on 	initialisation or reset checks (time frame = 200 ms)
Green	Flashing with 5 Hz 	no runtime system loaded (time frame = 200 ms)
Green	Flashing with 2 Hz 	Application = RUN (time frame = 200 ms)
Green	Permanently on 	Application = STOP

The red LED [DIA] signals the diagnostic status.

LED colour	Display	Description
Off	Permanently off 	No operating voltage
Red	briefly on 	initialisation or reset checks (time frame = 200 ms)
Red	Flashing with 10 Hz 	Application = STOP with error application program is stopped Cause: exceeded timeout of the application or visualisation: ▶ Delete the application! ▶ PowerOn reset ▶ Reload the application into the device (time frame = 200 ms)
Red	Flashing with 5 Hz 	Application = stopped because of undervoltage (time frame = 200 ms)
Red	Permanently on 	System error (FATAL ERROR): Application = STOP

### 1.3. Device Description and Configuration

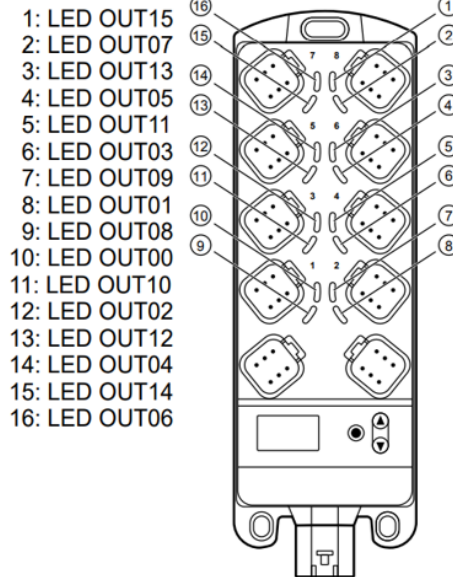
The CR2051 has 16 outputs in total, labeled OUT00 to OUT15. Each output is mapped to specific purpose, either single acting or complementary double acting solenoid. 6 of the outputs are single acting, and 8 outputs are committed towards 4 double acting solenoids in total.

Given here is an illustration of the LEDs on the device, and the mapped output for each.

The LEDs are operational for all 16 outputs regardless of the type of solenoid being used.

If the LED is lit, the corresponding output is at 12/24V state.

In the Holt specific software, the PWM output's LED is lit up when the master solenoid is switched on, or the PWM duty cycle is at the configured high state.



### 1.4. Mapped Outputs to Holt-Specific Purpose

OUTPUT	PURPOSE
OUT00	GravBar1
OUT01	GravBar2
OUT02	FireHose1
OUT03	FireHose2
OUT04	L1
OUT05	R1
OUT06	L2
OUT07	R2
OUT08	LRojo1
OUT09	LRojo2
OUT10	RRojo1
OUT11	RRojo2
OUT12	L3
OUT13	R3
OUT14	Not Used
OUT15	PWM MasterSolenoid

## 2.1. Display Output

The default display on the CR2051 signifies the most up to date output status requested on the CAN bus. It is a hexadecimal number that corresponds to the 16 outputs on the device. Each character in the string describes the state of 4 outputs in order.

The most significant bit (left side) points to OUT15 and the least significant bit (right side) points to OUT00. On startup, the status will show 0000, or all off.

Few examples from the 256 possibilities of the statuses:

Status	OUT															
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
FFFF	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0000																
0100							✓									
A001	✓		✓													✓
05C0						✓		✓	✓	✓						

✓- The output is high, or at 12/24V. This does not reflect valve state.

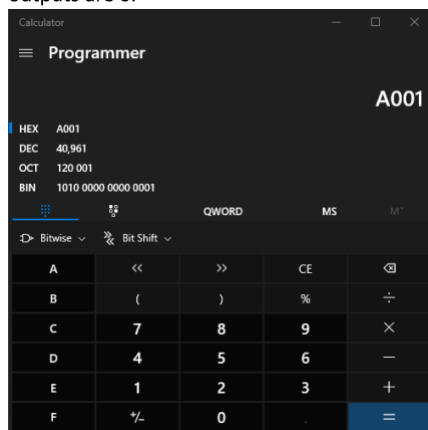
The same can also be verified with the amber LEDs beside each output, as shown in the diagram before.

## 2.2. Convenient way to decode the 4-digit display

Since the 4-digit display represents the output state in hexadecimal, an online converter, or a calculator with such features can be used to decode the string to get the current state easily.

For example, using the calculator built into Windows 10 and for the string A001:

1. Open the calculator application and switch to Programmer mode from the navigation drawer.
2. Click on "HEX" from the four options.
3. Type the string. In this case it is "A001".
4. Check the equivalent number in binary which will be under "BIN" and will update as you type the hexadecimal number.
5. The binary number represents 1 for +24/12V and 0 for off state. Read this number from right to left to match the outputs from OUT00 to OUT15. If there are less than 16 digits in the binary number, the other outputs are 0.



## IX: Electrical Schematics (also available for download)

