Troubleshooting Guide

Spray King® Water Tank

Models
SK-5-AT/SK-6-AT
SK-8-AT
SK-9-AT

Troubleshooting
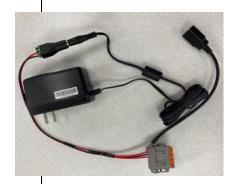
Troubleshooting Issue & Steps	Values	Results
1. Screen Does Not Power On		
a. **Check Fuses** There are two fuses located on the outside of the right side of the cab, behind the outer access panel.		Test fuses. If fuses are bad, replace. If fuses are OK, proceed to b.
b. **Check Power Circuits** Check power to screen. On 12 pin Deutz plug there are two 24 volt power circuits. Pin 1 is a solid red wire; Pin 3 is a red wire with white stripe.		Test for power. If power circuits are OK, proceed to c.
c. **Check Ground Circuit** The ground circuit to the screen is a W25 black wire. There should be continuity to the chassis ground.		If circuits OK, move to d.

Troubleshooting Issue & Steps	Values	Results
		After testing, if screen still does not power on, replace screen.
d. **Bench Test Screen** Bench test the screen using a 110 voltage adaptor test harness, part number WH10189 (pictured). If screen powers on there is a connection problem. Check Deutz connector for broken pins or bad connection to plug.		
2. Screen is on, but no function of spray heads and other optional accessories		
For Spray King tanks with a Crossfire Controller (pre-2022). For Spray King from 2022 with the IMF Controller, refer to Section VIII of the Appendix of this guide. a. **Check for blink codes** Check Crossfire controller mounted on underside of rear of water tank frame rail. Light will flash green and red when key if first turned on. During this time the screen is setting up programming in Crossfire for options setup from script file (see below). After 30 seconds the light should go solid green.		If the red light flashes, refer to blink code status.

Troubleshooting Issue & Steps	Values	Results

Crossfire Status LED Indicators

RED Codes

CANopen mode	State	Blinking Pattern
CAN Bus Off	LED ON	Constantly ON
CAN Bus Warning	LED Single Flash	Iso-phase on and off wth a frequency of approximately 2.5 Hz: (ON 200ms, OFF 200 ms)
Output Port Error	LED Blinking	Iso-phase on and off with a frequency of approximately 2.5 Hz: (ON 200ms, OFF 200ms) The red error blinking is only shown during interleaving 2.5 second intervals.

GREEN Codes

CANopen mode	State	Blinking Pattern
Operational	LED ON	Contantly ON
Pre-Operational Initializing	LED Blinking	One short flash: (ON 200 ms, OFF 1000 ms)
Stopped	LED Single Flash	One short flash: (ON 200 ms, OFF 1000 ms)

Troubleshooting Issue & Steps	Values	Results
b. **Solid Red Lamp Signal** A solid red lamp is a can bus failure. Can bus circuit: W39 Yellow wire W40 Green wire		Continuity checks must be made on can bus. From screen 12 pin connector to Crossfire 35 pin amp seal connector. Check yellow wire in pin 7 on screen plug to yellow wire on Crossfire connector pin 32. Check green wire on pin 18 to pin 33. If both circuits are OK, check the resistors. There are two 120 ohm resistors, one accessible at cab screen harness end, the other at Crossfire tank harness end. Remove each Delphi connector and check for 120 ohms resistance. If resistors are OK, repair bad connection in harness.

Troubleshooting Issue & Steps	Values	Results
c. **Single (Slow) Flash Red Signal** This is a can bus warning This is always caused by a bad connection or pins pushed back in connector. There is a possible bad crimp on terminal pins in connectors.		Locate, perform pull test on each circuit at all connectors – screen cab to tank, bulkhead, and Crossfire connector. Gently pull each wire to ensure crimp and pin are secure and locked in place. Check for pinched or cut wires.
d. **Multiple Flashing (Fast) Red Signal** This is an output error. Open door to hydraulic control box. Depending on model, there will be 4 to 6 electric hydraulic solenoids. With the key on, there should be one LED light on for each solenoid. This indicates power and ground are good. If one or more lights are out, there is a break in the circuit.		Ohm test across positive and negative terminals on hydraulic solenoid valves with connector removed. Ohm range should be 17 to 19 ohms. If outside this range, solenoid valve is bad. Replace as needed. Check connections at solenoid to din connector. Check or pushed pins or broken wires between the 12 pin Deutz plug in tank harness to hydraulic control box. Repair as needed.

Troubleshooting Issue & Steps	Values	Results
3. Hydraulic pump will not engage when hose reel or other functions are demanded.		
Is there a code logged on the Cat screen for hoist circuit? If yes, the script file will need to be reloaded into screen software. 		Call HOLT Manufacturing to get a copy of this file. a. **Download and install file** onto a USB thumb drive (3 KB file). Once downloaded, open the file on a Microsoft Windows based computer or laptop. Adjust high and low duty cycles to OEM specs. To obtain these specs, call HOLT Manufacturing, 844-465-8634. Set tank depth (supplied by HOLT Mfg.) and enable correct number of spray heads by changing spray heads (L1, L2, R1, and R2) to 1 for on and 0 for off. The water cannon/fire hose will be set to 1 if installed; hose reel will also be set to 1. If gravity bar is installed, set to 1 for on. When finished, proceed to step b.
		b. **Load Script into Screen** Once script file is set, load into screen via the USB connection plug in cab harness behind the screen. Install USB memory stick. Screen will go dark for approximately 15 seconds. When screen flashes, remove USB stick. Allow screen to fully boot. This can take up to 1 minute. Once main screen page appears, it is not ready until all side button lights stop flashing and a noticeable brightness appears on the screen. Check to see if the hydraulic operation is back. If not, proceed to step c.

Troubleshooting Issue & Steps	Values	Results
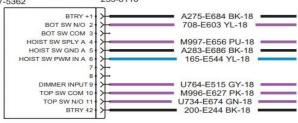
c. Check PWM Signal
Check PWM signal from screen to transmission ECM. The voltage is sent out on pin 4/blue wire at 12 pin Deutz plug on screen. This is a low voltage signal that has two resistors in line, one 1500 ohm and one 500 ohm. See Gilmore diagram for wiring details.

Check resistance on each resistor and continuity to ground. Check connections at shift hoist switch. The pink wire, number M996-E627 (730) is coming out at the hoist switch located directly under the shift lever control has been cut and terminated with a Deutz 2 pin signal wire connector. The other end has a 2 pin signal wire receptacle that the PWM blue wire is connected to. Check each of the male and female connections for pulled wire and plug fit.

(25) SHIFT HOIST LEVER (EJECTOR) E-C5
477-5362   253-8110

Pin		
BTRY +1	A275-E684 BK-18	
BOT SW N/O 2	708-E603 YL-18	
BOT SW COM 3		
HOIST SW SPLY A 4	M997-E656 PU-18	
HOIST SW GND A 5	A283-E686 BK-18	
HOIST SW PWM IN A 6	165-E544 YL-18	
7		
8		
DIMMER INPUT 9	U764-E515 GY-18	
TOP SW COM 10	M996-E627 PK-18	
TOP SW N/O 11	U734-E674 GN-18	
BTRY 42	200-E244 BK-18	
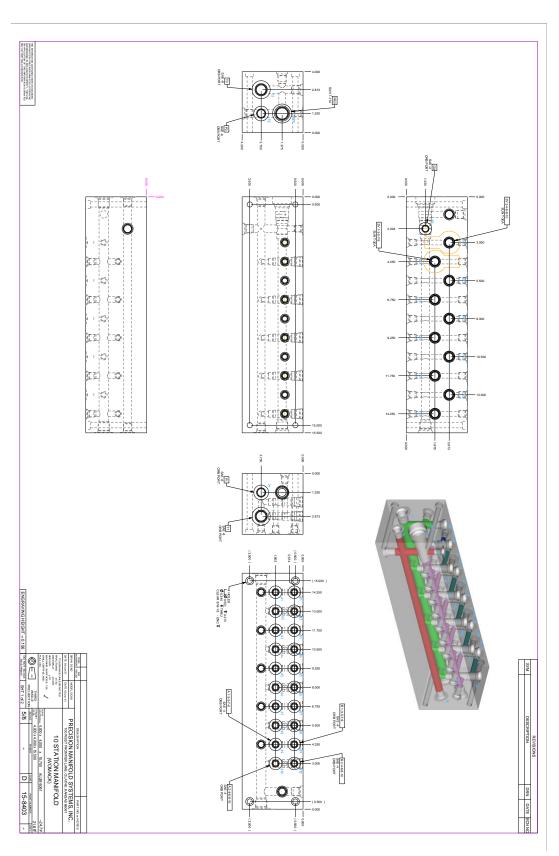
Troubleshooting Issue & Steps	Values	Results
4. Water level reads 0% when tank is full.		
a. Check LED lights are lit up on water sensor, located on top of tank. If there are no lights, check fuse, located on right side of cab behind outer panel.		Fuse needs replacing. If fuse is OK, proceed to b.
b. If fuse is OK, check voltage at three way connector on sensor harness, located in J box on front of tank. Red wire W11 is 24 volt – check voltage. Black wire W12 is ground; check ground to cab. White wire W19 is output signal to Crossfire control box.		If sensor lights are on, continue to c.
c. If sensor lights are on, check continuity from white wire W19 to pin C to ampseal on Crossfire pin 1. Check for pins pushed back in each connector.		
Changing the depth from the factory setting will cause inaccurate water level readings.		Water level sensor adjustment: Sensor should be extending into tank at the maximum length of sensor threads on some units. It is critical that any replacement sensor be installed at the same depth as the old sensor. This is the setting from the factory installation which is calibrated in the script file.
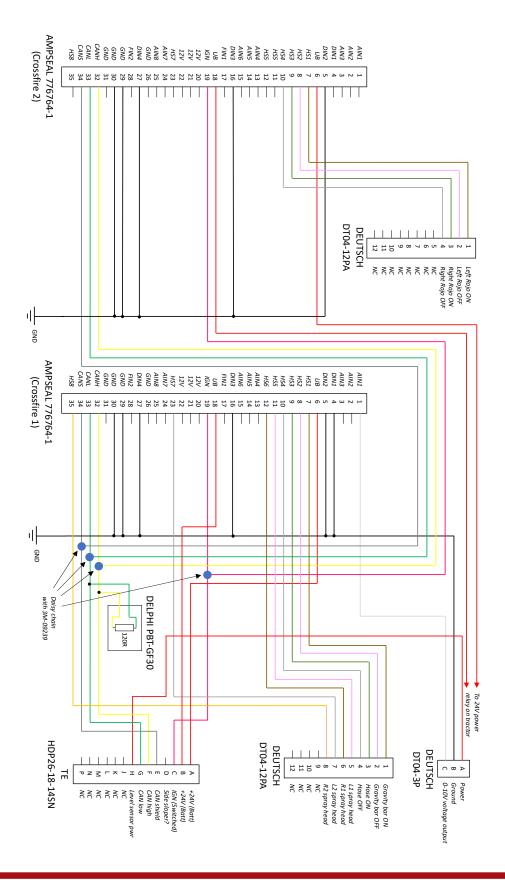
Appendix
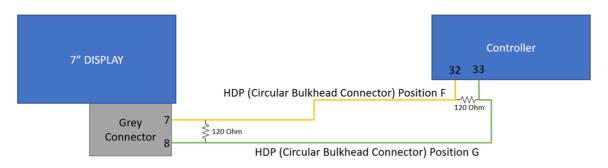
I.   Hydraulic Manifold Diagram
II.   Control Screen Wiring Diagram
III.   Deep Sea Screen Features and Pin Outs
IV.   Nitro Monitor Wiring Diagram
V.   IFM Hydraulic Controller Wiring Diagram

I. Hydraulic Manifold

Engineering drawing: 10 STATION MANIFOLD (WOMACK)

PRECISION MANIFOLD SYSTEMS, INC.
700 WEST FRONTIER LANE, OLATHE, KANSAS 66061

II. Control Screen Wiring Diagram

7" DISPLAY

Controller

32   33

Grey Connector

7

8

HDP (Circular Bulkhead Connector) Position F

120 Ohm

120 Ohm

HDP (Circular Bulkhead Connector) Position G
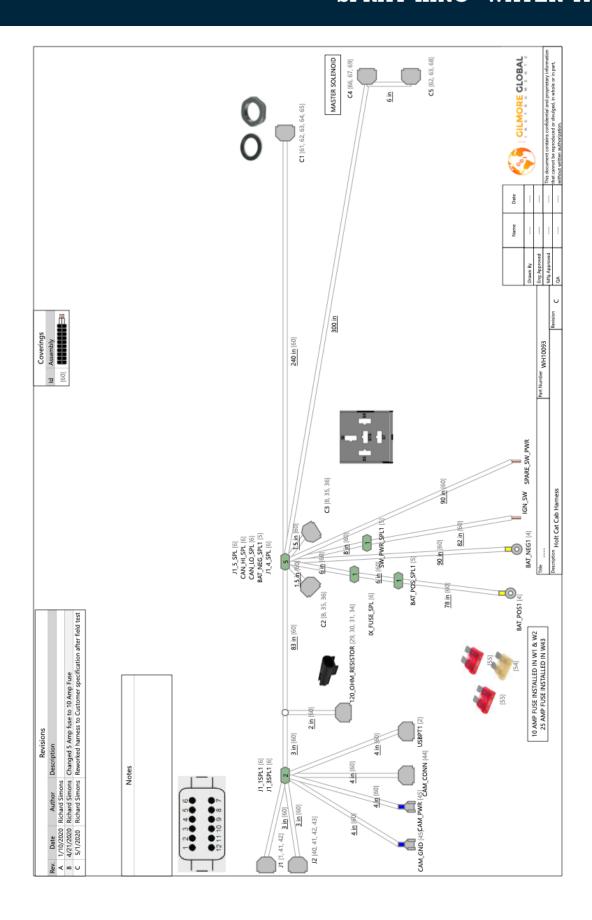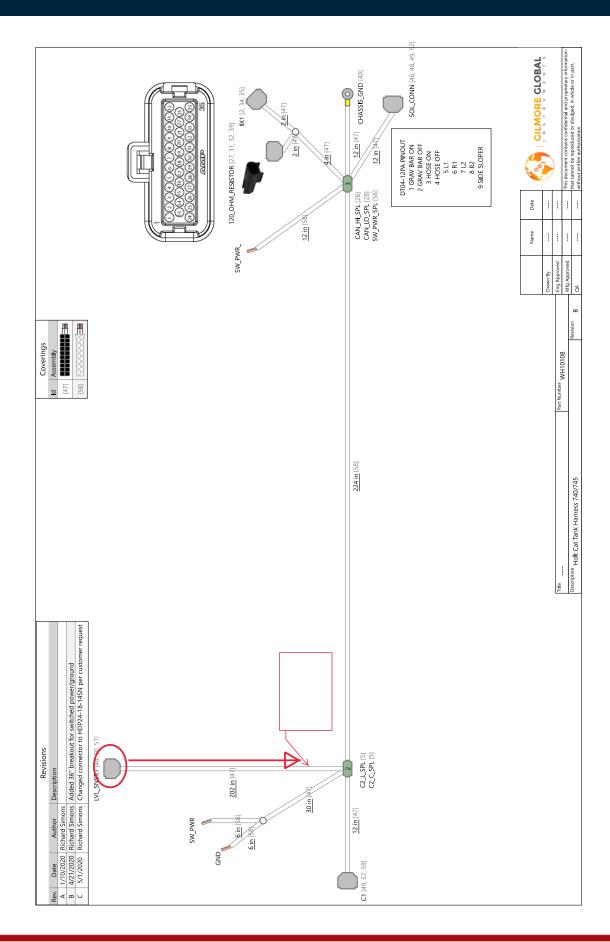
The yellow wire connects at position F on the HDP connector between the two harnesses, whereas the green wire is located at position G.

Holt Cab Harness

Part Number WH10093

Revision C

MASTER SOLENOID

C4 [66, 67, 69]
C5 [62, 63, 68]
C1 [61, 62, 63, 64, 65]

300 in
240 in [60]
6 in

Coverings

Id	Assembly
[60]	

C3 [8, 35, 36]
J1_5_SPL [6]
CAN_HI_SPL [6]
CAN_LO_SPL [6]
BAT_NEG_SPL1 [5]
J1_4_SPL [6]

15 in [60]
15 in [60]
8 in [60]
6 in [60]
6 in [60]

SW_PWR_SPL1 [5]
IGN_SW   SPARE_SW_PWR
90 in [60]
82 in [60]
BAT_NEG1 [4]
BAT_POS_SPL1 [5]
90 in [60]
78 in [60]
BAT_POS1 [4]

C2 [8, 35, 36]
IX_FUSE_SPL [6]
120_OHM_RESISTOR [29, 30, 31, 34]
83 in [60]

2 in [60]

10 AMP FUSE INSTALLED IN W1 & W2
25 AMP FUSE INSTALLED IN W43

[55]
[54]
[55]

3 in [60]
4 in [60]

J1_1SPL1 [6]
J1_3SPL1 [6]

USBPT1 [2]
4 in [60]
4 in [60]
CAM_CONN [44]
4 in [60]
CAM_PWR [45]
CAM_GND [45]

J1 [1, 41, 42]
J2 [40, 41, 42, 43]
3 in [60]
3 in [60]
4 in [60]

Revisions

Rev	Date	Author	Description
A	1/10/2020	Richard Simons	Changed 5 Amp fuse to 10 Amp Fuse
B	4/21/2020	Richard Simons	Reworked harness to Customer specification after field test
C	5/1/2020	Richard Simons	

Notes

	Name	Date
Drawn By	----	----
Eng Approved	----	----
Mfg Approved	----	----
QA	----	----

Title ------
Description Holt Cab Harness

GILMORE GLOBAL
INSTRUMENTS

Revisions

Rev.	Date	Author	Description
A	1/10/2020	Richard Simons	Added 36" breakout for switched power/ground
B	4/21/2020	Richard Simons	Changed connector to HDP24-18-14SN per customer request
C	5/1/2020	Richard Simons	

Coverings

Id	Assembly
[47]	
[58]	

DT04-12PA PINOUT
1 GRAV BAR ON
2 GRAV BAR OFF
3 HOSE ON
4 HOSE OFF
5 L1
6 R1
7 L2
8 R2
9 SIDE SLOPER

LX1 [2, 34, 35]
CHASSIS_GND [40]
SOL_CONN [46, 48, 49, 52]
120_OHM_RESISTOR [27, 31, 32, 39]
CAN_HI_SPL [28]
CAN_LO_SPL [28]
SW_PWR_SPL [56]
SW_PWR_
LVL_SNSR1 [46, 50, 51]
SW_PWR
GND
C1 [49, 57, 59]
C2_L_SPL [5]
C2_C_SPL [5]

2 in [47]
2 in [47]
4 in [47]
12 in [47]
12 in [47]
12 in [58]
224 in [58]
202 in [47]
30 in [47]
12 in [47]
6 in [58]
6 in [58]
35
AMP

GILMORE GLOBAL
INSTRUMENTS

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

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

III. Deep Sea Screen Features and Pin Outs

DSEControl®

DSE

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 (M870-01 / M870-02 / M870-03)		SP12 Patch 0
Qt (M870-04)		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

055-159/03/21 (B)

DSEControl®

DSE

Technical Data

DSE M870
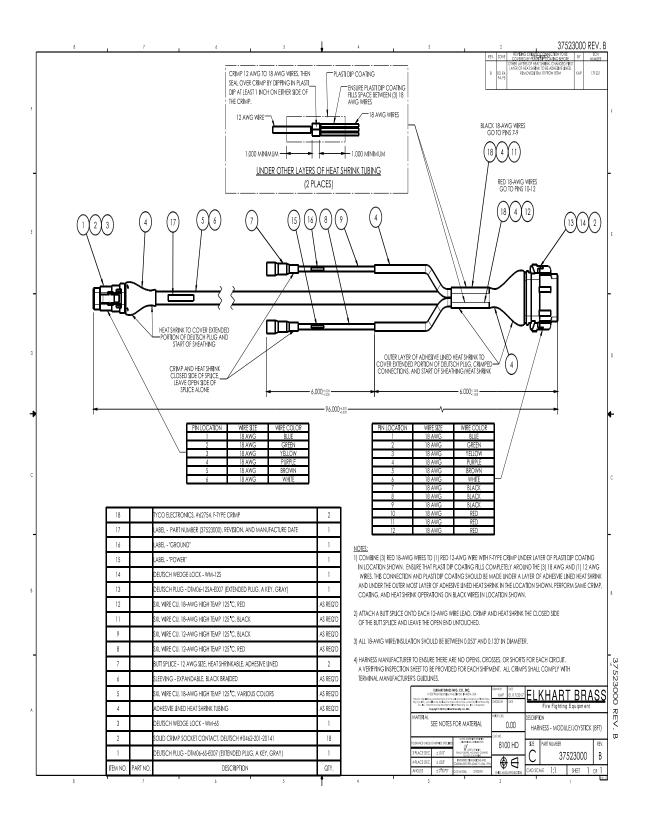
Supply		Connector A
Operating voltage	8 V DC to 32 V DC	Pin 7
Unit power supply maximum current consumption, full backlight (no external loads)	< 1000 mA at 12 V and 24 V	
Unit power supply maximum current consumption, full backlight and heater (no external loads)	< 1500 mA at 12 V and 24 V	
Unit power supply current consumption after controlled shutdown has occurred due to the ignition being turned off	< 5 mA at 24 V	

Fusing		Connector A
Unit power supply external protection fuse rating	3 A	Pin 7
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

Housing	
PC PBT alloy plastic resin	

Dimensions	
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)	

Weight	
< 1 kg	

Temperature	
Operating temperature	-30 °C to +85 °C / -22 °F to +185 °F
Storage temperature	-40 °C to +85 °C / -40 °F to +185 °F

Protection Rating	
	IP67 (with mating connectors)

Display	
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)

Connectors	
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

Digital Inputs		Connector C
Digital inputs configured high or low		Pin 14, 15, 16, 17
High level voltage threshold	> 6 V	
Low level voltage threshold	< 2 V	

Analogue Voltage Inputs		Connector C
0 V to 5 V programmable voltage range	0 V to 5 V	Pin 14, 15, 16, 17
0 V to 10 V programmable voltage range	0 V to 10 V	
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		

055-193/03/21 (M)

IV. Nitro Monitor Wiring Diagram

37523000 REV. B

REV.	ZONE		BY	ECN NUMBER
B	B3, E4, F4, F5	REVERSED CRIMPED CONNECTION TO BE COVERED BY PLASTI DIP COATING BEFORE OTHER LAYERS OF HEAT SHRINK. CHANGED FIRST LAYER OF HEAT SHRINK TO BE ADHESIVE LINED. REMOVED ITEM 10 FROM BOM.	KAP	171221

CRIMP 12 AWG TO 18 AWG WIRES, THEN SEAL OVER CRIMP BY DIPPING IN PLASTI DIP AT LEAST 1 INCH ON EITHER SIDE OF THE CRIMP.

PLASTI DIP COATING

ENSURE PLASTI DIP COATING FILLS SPACE BETWEEN (3) 18 AWG WIRES

12 AWG WIRE

18 AWG WIRES

1.000 MINIMUM   1.000 MINIMUM

UNDER OTHER LAYERS OF HEAT SHRINK TUBING
(2 PLACES)

BLACK 18-AWG WIRES GO TO PINS 7-9

RED 18-AWG WIRES GO TO PINS 10-12

HEAT SHRINK TO COVER EXTENDED PORTION OF DEUTSCH PLUG AND START OF SHEATHING

CRIMP AND HEAT SHRINK CLOSED SIDE OF SPLICE, LEAVE OPEN SIDE OF SPLICE ALONE

OUTER LAYER OF ADHESIVE LINED HEAT SHRINK TO COVER EXTENDED PORTION OF DEUTSCH PLUG, CRIMPED CONNECTIONS, AND START OF SHEATHING/HEAT SHRINK

6.000   6.000

96.000

PIN LOCATION	WIRE SIZE	WIRE COLOR
1	18 AWG	BLUE
2	18 AWG	GREEN
3	18 AWG	YELLOW
4	18 AWG	PURPLE
5	18 AWG	BROWN
6	18 AWG	WHITE

PIN LOCATION	WIRE SIZE	WIRE COLOR
1	18 AWG	BLUE
2	18 AWG	GREEN
3	18 AWG	YELLOW
4	18 AWG	PURPLE
5	18 AWG	BROWN
6	18 AWG	WHITE
7	18 AWG	BLACK
8	18 AWG	BLACK
9	18 AWG	BLACK
10	18 AWG	RED
11	18 AWG	RED
12	18 AWG	RED

ITEM NO.	PART NO.	DESCRIPTION	QTY.
18		TYCO ELECTRONICS, #62754, F-TYPE CRIMP	2
17		LABEL – PART NUMBER (37523000), REVISION, AND MANUFACTURE DATE	1
16		LABEL – "GROUND"	1
15		LABEL – "POWER"	1
14		DEUTSCH WEDGE LOCK – WM-12S	1
13		DEUTSCH PLUG – DTM06-12SA-E007 (EXTENDED PLUG, A KEY, GRAY)	1
12		SXL WIRE CU, 18-AWG HIGH TEMP 125°C, RED	AS REQ'D
11		SXL WIRE CU, 18-AWG HIGH TEMP 125°C, BLACK	AS REQ'D
9		SXL WIRE CU, 12-AWG HIGH TEMP 125°C, BLACK	AS REQ'D
8		SXL WIRE CU, 12-AWG HIGH TEMP 125°C, RED	AS REQ'D
7		BUTT SPLICE – 12 AWG SIZE, HEAT SHRINKABLE, ADHESIVE LINED	2
6		SLEEVING – EXPANDABLE, BLACK BRAIDED	AS REQ'D
5		SXL WIRE CU, 18-AWG HIGH TEMP 125°C, VARIOUS COLORS	AS REQ'D
4		ADHESIVE LINED HEAT SHRINK TUBING	AS REQ'D
3		DEUTSCH WEDGE LOCK – WM-6S	1
2		SOLID CRIMP SOCKET CONTACT, DEUTSCH #0462-201-20141	18
1		DEUTSCH PLUG – DTM06-6S-E007 (EXTENDED PLUG, A KEY, GRAY)	1

NOTES:

1) COMBINE (3) RED 18-AWG WIRES TO (1) RED 12-AWG WIRE WITH F-TYPE CRIMP UNDER LAYER OF PLASTI DIP COATING IN LOCATION SHOWN. ENSURE THAT PLASTI DIP COATING FILLS COMPLETELY AROUND THE (3) 18 AWG AND (1) 12 AWG WIRES. THIS CONNECTION AND PLASTI DIP COATING SHOULD BE MADE UNDER A LAYER OF ADHESIVE LINED HEAT SHRINK AND UNDER THE OUTER MOST LAYER OF ADHESIVE LINED HEAT SHRINK IN THE LOCATION SHOWN. PERFORM SAME CRIMP, COATING, AND HEAT SHRINK OPERATIONS ON BLACK WIRES IN LOCATION SHOWN.

2) ATTACH A BUTT SPLICE ONTO EACH 12-AWG WIRE LEAD, CRIMP AND HEAT SHRINK THE CLOSED SIDE OF THE BUTT SPLICE AND LEAVE THE OPEN END UNTOUCHED.

3) ALL 18-AWG WIRE/INSULATION SHOULD BE BETWEEN 0.053" AND 0.120" IN DIAMETER.

4) HARNESS MANUFACTURER TO ENSURE THERE ARE NO OPENS, CROSSES, OR SHORTS FOR EACH CIRCUIT. A VERIFYING INSPECTION SHEET TO BE PROVIDED FOR EACH SHIPMENT. ALL CRIMPS SHALL COMPLY WITH TERMINAL MANUFACTURER'S GUIDLINES.

ELKHART BRASS MFG. CO., INC.
AT 302 West Beardsley Ave, Elkhart, IN 46514, USA

DRAWN BY: KAP   DATE: 01/17/2017
CHECKED BY: DATE:

ELKHART BRASS
Fire Fighting Equipment

MATERIAL: SEE NOTES FOR MATERIAL
WEIGHT (LBS): 0.00
CAT.NO.: 8100 HD

DESCRIPTION: HARNESS – MODULE/JOYSTICK (8FT)

TOLERANCE UNLESS OTHERWISE SPECIFIED
3 PLACE DEC. ± .010"
4 PLACE DEC. ± .005"
ANGLES

SIZE: C   PART NUMBER: 37523000   REV.: B
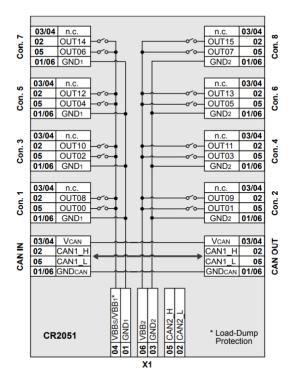CAD SCALE: 1:1   SHEET 1 OF 1

37523000 REV. B

V: IFM Controller Wiring Diagram

<u>CR2051 – GUIDE TO HOLT/GGI SOFTWARE</u>

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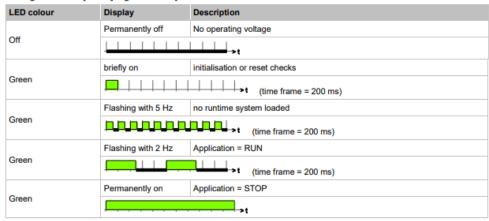
☐ **CR2051 seems to power on but the built-in display does not work:** Check the power lines and make sure all the ignition power and grounds are connected. Additionally check if the LEDs on the CR2051 (located just above the 4-digit display) are in any error state.

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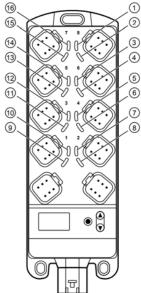
Given here is an illustration of the LEDs on the device, and the mapped output for each.

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: LED OUT15
2: LED OUT07
3: LED OUT13
4: LED OUT05
5: LED OUT11
6: LED OUT03
7: LED OUT09
8: LED OUT01
9: LED OUT08
10: LED OUT00
11: LED OUT10
12: LED OUT02
13: LED OUT12
14: LED OUT04
15: LED OUT14
16: LED OUT06
```

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.