



Black Tip TM

(BT 108, BT 210, BT 310)

Operation Manual

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Limited Warranty

Cirus Controls, LLC.

What and who is covered?

This warranty covers all defects in materials or workmanship in your Cirus Controls system under normal use, maintenance and service. This warranty coverage applies only to the original owner and is not transferable.

How long is the warranty period?

This warranty coverage runs for a period of 1 year from the date of initial installation (or 13 months from date of shipment from Cirus Controls), whichever occurs first. Replacement parts are warranted for the remaining portion of the original warranty period or thirty (30) days from date of shipment from our factory (whichever is greater).

How can you get service?

Cirus Controls' obligation under this warranty is limited to repairing and/or replacing, at Cirus Controls' option, any part or parts that are determined, by Cirus Controls, to be defective. To be eligible for any claim under this warranty, the owner (or Cirus authorized dealer) must return any defective part(s) to the factory, within the applicable warranty period (as set out above).

What will we do?

Cirus Controls' may, at its option, elect to grant adjustments in the field through an authorized representative and may thereby elect to waive the requirement that parts be returned to Cirus Controls' factory. The repair or replacement of defective parts under this warranty will be made without charge to the owner except for transportation of the part to our authorized repair location.

What is not covered under this warranty?

Cirus Controls will not assume any expense or liability for repairs made outside our plant without our prior written consent. We are not responsible for damage to any associated equipment or product and will not be liable for loss of profit or other special damages.

The provisions of this warranty do not apply to any product or parts which have been subject to misuse, negligence or accident, or which have been repaired or altered outside of Cirus Controls' factory in any way (in the judgment of Cirus Controls) so as to affect adversely its performance or reliability. Neither does this warranty apply to normal maintenance service and parts or to normal deterioration due to wear and exposure.

This warranty is expressly in lieu of other warranties, expressed or implied, in fact or by law, including any implied warranty of merchantability of fitness for a particular purpose. The remedies of repair or replacement as set forth are the only remedies under this warranty; Cirus Controls' disclaims any obligations or liability for loss of time, inconvenience, commercial loss or direct consequential, special or incidental damages. This warranty is in lieu of any other obligation or liability of Cirus Controls' of any nature whatsoever by reason of the manufacture, sale, lease or use of such products and Cirus Controls neither assumes, nor authorizes anyone to assume for it, any other obligation or liability in connection with such products.

Revision level of this manual

Rev Letter	Date	Detail
A	7/6/05	Initial Release
B	10/11/05	SafeStik, Channel Safe details added.
C	8/14/06	Hoist limit function;
D	4/27/07	Hoist lockout and over-ride capability added
E	3/9/09	BT210 added
F	1/19/10	BT310 added

Cirus Controls reserves the right to make revisions to this manual without notice.

Package Contents

A complete **Black Tip**TM control system contains the following items:

- 1) **Black Tip**TM control unit;
- 2) **Mako Trim**TM program for the PC on a CD;
- 3) This manual;
- 4) Power cable;
- 5) Hydraulic control cables ordered;
- 6) Switches and Indicator wiring harness;

If any of these items are missing, please contact your distributor for replacement parts.

Functional Overview

The **Black Tip**TM control system is a 10 channel proportional hydraulic controller. It translates movements from a joystick(s) to movements of truck implements such as plows, hoists and hook lifts. The closer the joystick is to center (neutral) the slower the implement will move; the further from center the faster the implement will move. The **Black Tip**TM system is field-configurable using a PC connection. This allows the end user to tailor the speed of each individual function or to turn on and off certain functions. For example, set the speed of the “plow down” different from the “plow up” speed.

Black TipTM Top View (Shown with optional Dual Spread spreader control)



Backlighting “on”: indicates power is on to the system.

***Black Tip*TM Cable Connections (see drawing for detail at end of manual)**

Connections:

BT 1001: 10-pin Wago (orange) connector used for inputs and outputs to switches and indicators.

PC Port: standard PC serial connection used for field setting trims and other configuration options. (Optional cable)

PWR / GND: 4-pin Molex used for connecting power and ground to system (Standard cable);

Hook: Two, (2 pin) Molex connector for hydraulics output for hook lift (optional cable);

Hook Left / Right: 2-pin Molex connector used for hydraulic outputs for hook in/out, or wide out plow cylinders. Cables sold separately.

BT HYD: 10-pin Molex connector used for controlling a Hoist, Plow, Auger and Spinner (for EZ Spread, Spread DR and Dual Spread); TS-2031 included with system.

Double Acting Float: 2 pin Molex connector used for controlling dump valve for plow lift. Cables ordered separately.

Cartridge Valve: 2 pin Molex connectors used for controlling system unloader valve. Cables ordered separately.

Auger, Spinner, Pre-wet: 2 pin Molex connectors for hydraulic outputs for spreader (auger reverse and pre-wet). Cables ordered separately.

Aux Input: input port for hoist limit and other sensors, optional cable required

Speedo Port: 4 pin Molex connector for TS-2004 cable for use with Ground Speed Oriented controllers (optional).

Sensor Port: 6 pin Molex connector for use with TS 2000 sensor input cable system or Hoist lockout key switch. Optional cable required.

Pre-Delivery System Setup Checklist

	Description	Completed By/Date
Step 1	Install System and connect cables	
Step 2	Test the Signal Outputs	
Step 3	Configure the Joystick	
Step 4	Trim hydraulics for all axes of motion	

Step 1- Installing the control unit

The ***Black Tip*TM** control unit may be mounted on a pedestal using the PEM nuts provided on the base of the unit or inserted into the optional padded console for a bench seat. **Do not mount the control unit with the “cable end” facing up.**

Connecting the cabling

Note: Modification of any factory wiring in the joystick pod, arm unit, *Black Tip*TM unit or drilling holes in any of the sheet metal housings voids the product warranty.

1) Verify that power switch is off. Connect the hydraulic cables to the labeled ports. Cable is labeled on the sleeve with TS 2031.

2) Connect the orange “Wago” input plug and wire it to the systems on truck using BT-1001.

3) Finally, connect the power cable (MK 1003) to the unit. Check to make sure that the power switch is off before connecting the power leads, and then connect power and ground to the cable.

The ground source must be direct to the battery. A chassis ground is not adequate. The power cable can be connected either directly to the battery, as the unit is fused, or to a power circuit capable of delivering a minimum of 10 amps.

Step 2 - Testing the signal outputs

WARNING: KEEP ALL PERSONNEL CLEAR OF MOVING PARTS!

With the truck off, turn on the system and wait 5 seconds for self-test to complete. Move a joystick on the **Black Tip**TM. Move the joystick up and check for the correct LED lighting up on the valve junction box out by the valve body. Repeat this for every function on the truck. Once that is complete, start the truck, and repeat. The implements should now move when each function is selected. The speeds of the functions can be tailored using the **Mako Trim**TM configuration tool, which is described in the Trimming step.

Step 3 – Configure the Joystick

Joystick Protection and Failure Diagnosis

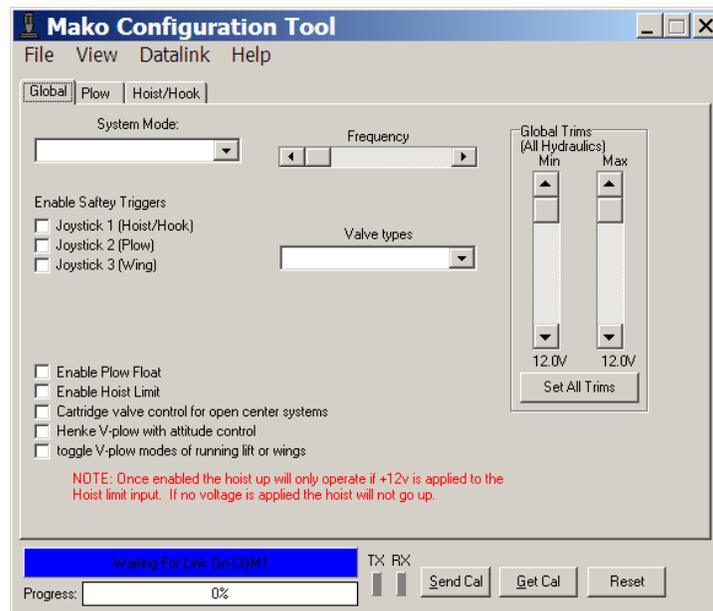
All **Black Tip**TM joysticks are true “Hall Effect” magnetic joysticks. When handled properly, these joysticks will give long service since there are no “contact parts” inside.

Joystick Damage Prevention: Joysticks can be damaged by incorrect wiring. Joysticks are installed, wired and tested at the factory and must not be touched in the field by anyone other than a qualified technician. See Appendix C for plug in locations.

Do not “plug in” or “un-plug” either joystick harness with power on or joystick will be damaged and warranty will be voided.

System Configuration

- 1) To adjust trims, or system parameters plug a standard serial cable into the PC port on the **Black Tip**TM plow control. Use the latest version of **Mako Trim**TM. Current versions are posted on Cirrus Controls’ website. Verify that the COM port on the PC is available. Open the **Mako Trim**TM configuration utility. The program opens on the “Joysticks” screen.
- 2) After the **Mako Trim**TM program is opened, turn on the **Black Tip**TM plow control. The red bar that says waiting for link will turn green. At this point the PC has uploaded the current configuration in the **Black Tip**TM and now controls the **Black Tip**TM plow control. (Note: that the current joystick’s screen changes to display the current configuration of the **Black Tip**TM



- 3) From the system mode menu, use the other pull down menus to assign each joystick to the hydraulic function desired and use the check boxes to assign top switches as desired.
- 4) Once joysticks are configured, follow instructions in the trimming section to trim each device.
- 5) Click “send cal” to send new configuration to Black Tip controller and save the file.

Step 4 Set Up for Operation – Trimming

Overview of Trims for Proportional Control of Motion (Feathering)

Setting trims is the process of setting minimum and maximum signal voltages for the valve coil that result in a fine-tuning of the range of proportional control available to the operator. Proportional control of motion allows the operator to move the control joystick a small amount to control low-speed movement and a large amount to control high-speed movement. When properly set, the operator can “feather” the control joystick and move the implement (plow, dump body) at the rate of speed that is appropriate to the task at hand for best safety and efficiency.

Trims can be set at the outer limits of the electro-hydraulic system’s capability for proportional control of motion or they can be narrowed to a tighter range of control. The larger the difference in voltage between the minimum and maximum settings, the larger the range of movement of the control joystick and the finer degree of proportional control of motion is available to the operator.

Minimum Trim: the minimum signal voltage delivered to the coil necessary to result in enough flow of hydraulic fluid to begin to move the implement selected. This voltage value will vary based on the valve coil in use, the size of the hydraulic system, the size of the hydraulic cylinder and the weight of the implement (dump body, plow, wing etc). Minimum settings can only be determined at operating engine rpm's with hydraulic fluid warmed to its operating temperature.

Maximum Trim: the maximum signal voltage delivered to the coil necessary to result in enough flow of hydraulic fluid to reach the maximum speed of motion of the implement intended. This voltage value will vary based on the valve coil in use, the size of the hydraulic system, the size of the hydraulic cylinder and the weight of the implement in use (dump body, plow, wing etc) and is normally pre-set at the factory.

Typical Settings (largest difference between min and max settings): choosing these settings results in the largest amount of proportional control available for that hydraulic system. The operator will be able to make large and small adjustments to speed of motion by moving the control joystick a corresponding amount.

Bang /Bang Control (On/Off): Set the minimum and maximum trim voltage levels at 12V. Zero proportional control of speed is available at this setting.

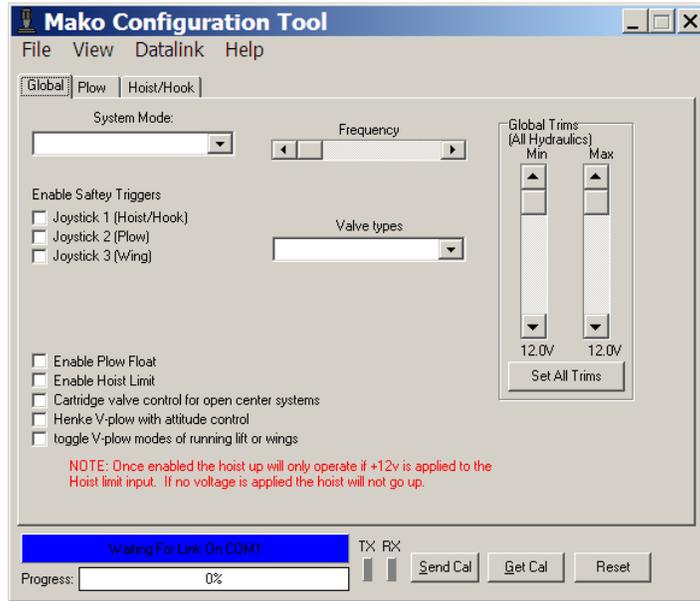
Other Setting Combinations: because each implement has performance characteristics, setting trims uniquely for each one will create the best sense of control for both safety and efficiency.

Instructions for Setting Trims

In order for a **Black Tip**[™] plow control system to proportionally move implements the system may have to be trimmed. The unit comes factory set for a variety of different coils, which allows the unit to run without changes. However if some of the implements don’t move as desired, they can be adjusted by setting new min and max trim settings via the **Mako Trim**[™] configuration program which can be found on the CD accompanying the system user manual. **Mako Trim**[™] is

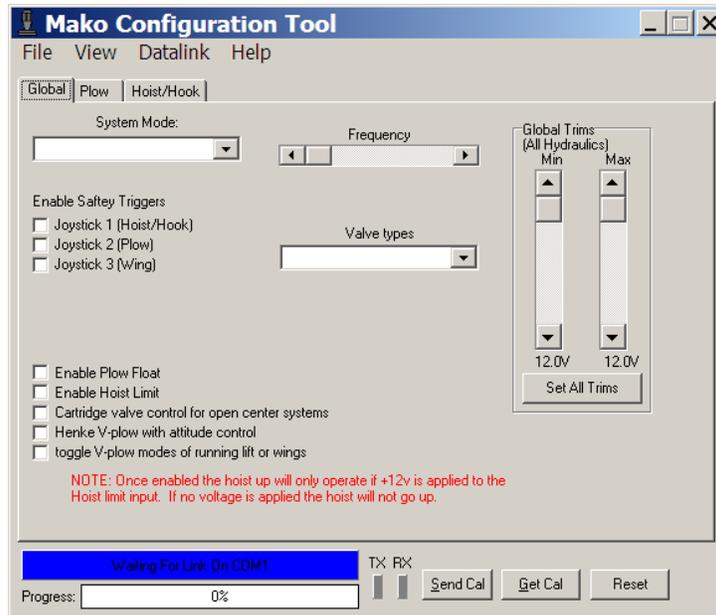
compatible with personal computers (PC) or laptops running Windows 2000, XP or Vista operating system.

1) To adjust trims, or system parameters plug a standard serial cable into the PC port on the **Black Tip™** plow control. Validate that you are using the latest version of **Mako Trim™**. Current versions are posted on Cirus Controls' website. Verify that the COM port on the PC is available. Open the **Mako Trim™** configuration utility. The program opens on the "Joysticks" screen.



2) After the **Mako Trim™** program is opened, turn on the blue **Black Tip™** plow control. The red bar that says waiting for link will turn green. At this point the PC has uploaded the current configuration in the **Black Tip™** and now controls the **Black Tip™** plow control.

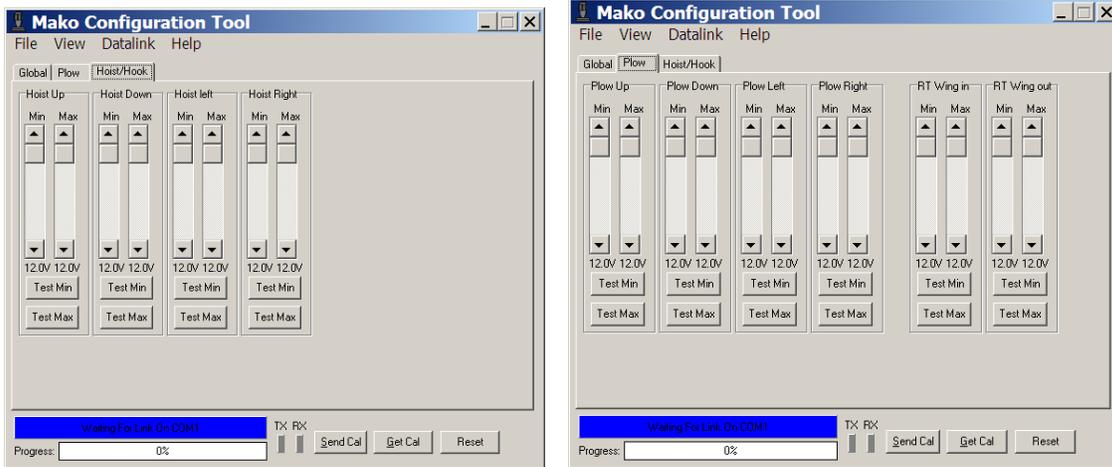
Global Trims Tab



This screen is used for setting the coil type, coil frequency, and setting all the trims to be the same with the global trim sliders. Use the slider to select the voltage desired and then selects “set all trims” to apply those values to all channels on the system.

Test and Set Trims for Each Channel

If wish to set trims individually for each implement, use the next 2 tabs to do so for all the axes of motion. To set the hoist trims simply click the hoist/hook tab.



Using the PC to Identify the Minimum Voltage:

Caution, the hoist will move, keep all personnel clear before beginning.

- 1) With the truck running, move the hoist up slider in 0.1 volt increments. Each mouse click will move the value up 0.1V and the displayed value will change.
- 2) After each increase press and hold the “TEST MIN” button. This will tell the *Black Tip™* box to move the hoist at the set level. It is not necessary to move the joystick.
- 3) If the hoist doesn’t move, move the slider and repeat the process until the hoist just starts to move. “Ideal” min. voltage is the point at which the hoist barely moves with “test min.”
- 4) To set the next channel independently, select the tab for the next implement and repeat.

Maximum Trim Voltage

The maximum voltage setting is pre-set at the factory to match the valve coil in use on this system. The max trim can be reduced below the pre-set level to (from full on to barely moving) by moving the max slider downward. This type of “lowered maximum” is used to balance the speed of a “lighter” implement to keep it from banging when run at top speed.

Increasing the maximum voltage will only increase speed of motion up to the maximum capacity of the hydraulic system, increasing max voltage above that point will not increase the speed.

Using the PC to Set the Maximum Voltage:

Caution, the hoist will move, keep all personnel clear before beginning.

- 1) With the truck running, move the “hoist up max slider” down in 0.1 volt increments. Each mouse click will move the value down 0.1V and the displayed value will change.
- 2) After each increase press and hold the “TEST MAX” button. This will tell the *Black Tip™* to move the hoist at the set level. Do not move the joystick.

- 3) Final setting will depend on the desired maximum speed you seek. Observe the speed at several Max settings and choose the speed that meets your needs.
- 4) To set the next channel independently, select the tab for the next implement and repeat.

Upload and Store the Trim and Settings

Once all the trims are set to the users liking, they must be uploaded to the **Black Tip™** box by clicking the “Send Cal” button.

NOTE: TRIMS ARE NOT UPDATED OR SAVED IN THE SYSTEM UNTIL THE SEND CAL BUTTON IS PRESSED.

This file can also be saved on the PC by clicking the file menu and saving the configuration. When the PC is connected to a printer, the numerical values can be printed for your records.

Downloading Trim and Settings – Backup Copy

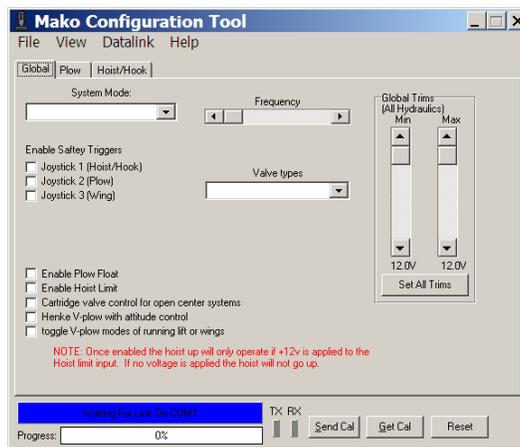
In the event you wish to download the trim setting from a **Black Tip™** box. Connect the PC as before, and simply press the “Get Cal” button. Save the new file on your PC.

Using Stored Trims and Settings – Restore Settings

You may use a settings file on your PC to upload an existing configuration to **Black Tip™**. Connect the PC to the **Black Tip™** plow control as before and click on “Send Cal.” The **Black Tip™** plow control now is configured with the settings from the stored file.

Optional Hoist Limit with optional override or lockout

Black Tip™ offers the option to limit the hoist circuit using an optional proximity sensor and cabling. With the sensor installed and the hoist limit enabled in **Mako Trim™**, the **Black Tip™** will not allow the hoist to be raised above the position of the sensor unless it receives a “true” signal back from sensor. The sensor will only report “true” when the following conditions are met: the sensor and cable are intact and functional, the hoist position is below the chosen limit position and the optional key switch is in the “hoist enable” position. Using the optional key switch, the hoist limit circuit can be over ridden or the hoist can be completely locked out for seasonal or safety reasons. Use of these features requires purchase and installation of the sensor, cable and key switch. See wiring diagram and BOM in the attached drawings. **Note: if the hoist limit is enabled (by checking above) and a sensor is not installed, the Black Tip™ cannot raise the hoist even though all systems are functional.**



System Self-Diagnostics and Troubleshooting

Joystick Check during Startup

During each system power up, the **Black Tip™** tests each joystick for proper electrical function. This test takes approximately 5 seconds after power is turned on. Should the **Black Tip™** identify a bad joystick during power up, it will automatically cancel all of the joystick outputs to protect the hydraulic system until the joystick problem is corrected.

Joystick failure or system disable: Green “hoist LED” blinks slowly;



Joystick failure during operation (SafeStik™**) – Blinks Slow**

In the event that a joystick axis fails during operation, the **Black Tip™** system automatically recognizes the failure and disables the failed axis. In this event (single axis failure), all other joystick axis will function properly. To confirm the diagnosis, shut off the system power for 5 seconds and then re-start the system. Upon power up, the system self test will recognize the failed axis and cause the “hoist LED” to blink slowly confirming the failure and then you can replace the joystick or return the unit for service.

Shorted or Open Circuit on Output channels – Blinks Fast

The **Black Tip™** system is designed to recognize when an output channel is connected to a shorted or open circuit. This protection ensures that the system stops sending an output signal to the affected device until the problem is resolved. The failure indication is a flashing green Hoist LED adjacent to the joystick. The LED will flash slowly while the operator attempts to actuate the damaged circuit by moving the joystick toward the damaged function. If only one output channel (controlled by one direction of joystick motion) is damaged, only that output channel is shut off by the **Black Tip™** system until repairs can be made.

Trouble Shooting Guide

Complaint	Cause (s)	Correction (s)
Power Isn't On	a) Master Power Off; b) Fuse is blown; c) Bad Power or Ground connection;	a) Turn on power; b) Replace Fuse c) Verify power/ground connections.
Black Tip cuts out or acts strange;	Low power supply voltage from truck battery/alternator;	Minimum truck voltage must be > 12.0 volts;
Plow or Hoist Doesn't Move	a) PTO not engaged; b) Hydraulics not functioning; c) Electrical connection failure; d) Black Tip power off; e) Joystick malfunction; f) Hoist limit is enabled;	a) Engage PTO; b) Verify Hydraulics: actuate plow or hoist; manually operate using manual over-ride on valve; c) Check LED at coil connection and at valve junction box; Repair cable; d) Check wiring and switch; e) "Power up" joystick self test; Repair/replace indicated joystick. f) Correct hoist limit conditions;
System doesn't respond to joystick (initial setup)	a) Black Tip not configured to match the joystick system in truck; b) One or more joysticks have failed and Black Tip has canceled the output signal to protect the hydraulic system;	a) Use Black Tip Trim to configure the system to match the joystick installed in the truck. b) See Joystick Safety section in this manual to diagnose which joystick has failed;
Implement (plow or hoist) moves without actuating joystick;	a) Output signal on at all times;	a) Verify joystick cable is plugged in properly on both ends; b) Verify that individual joysticks are plugged into joystick PCB in arm unit. c) Joystick was damaged by incorrect wiring and must be replaced.
"Hoist LED" Flashes (fast or slow) (Note: system has one LED and it will flash if either Hoist or Plow circuits have defect).	a) Flashes slowly – joystick failed; b) Flashes rapidly (only when joystick is moved in a particular direction), stops flashing when stick returns to neutral;	a) Replace joystick; b) Shorted or open circuit external to the Black Tip. Investigate the wiring and coil in the device controlled by the axis of motion that causes the flashing LED. (I.e. LED flashes when moving joystick for "hoist up." Troubleshoot wiring and Hydraulic coil for "hoist up" function.).

Appendix A: Spare parts list

Black Tip 108 & 208

000848	HFX Dual Axis Joystick (Standard joystick for BT 108 system)
000845	HFX Single Axis Joystick
MK-1003	Black Tip Power Cable
TS-2004	Black Tip Speedometer cable (optional with spreader)
001032	Printed Lens for Sprague Switch and Sprague Indicators
BT-1000	Black Tip indicator & Switch cable (internal harness)
BT-1001	Black Tip indicator & Switch cable (external cable, fly lead termination)

IP 68 Valve Junction Box Parts

TS-2031	8 (active) Port Junction Box
SF-100x	Hydraulic Connection for single wired connections
TS 2010	24" Pigtail with AMP Jr. termination (2 pin)
TS-2011	24" Pigtail with Weatherpak termination (2 pin, tower half)

TS 2012	24" Pigtail with AMP termination (2 pin)
TS 2013	24" Pigtail with C2 (ITT Canon) Termination
TS 2014	24" Pigtail with DIN Terminations
TS-2017	24" pigtail w Metripak terminations
TS-2020	24" pigtail w Deutsch terminations

Appendix B – Glossary of Plow Control Terms

Black Tip™: Multiple joystick system for controlling plowing systems.

Mako Trim™: Windows compatible software for configuration of plow control system.

Proportional Control: the ability to control motion of a plow in a smooth, feathering manner from slowest to fastest speed of motion possible for a given hydraulic set up. The closer the joystick is to center (neutral) the slower the implement will move; the further from center the faster the implement will move.

Bang-Bang Control: the ability to control motion of a plow as either fully on or fully off resulting in a single speed of motion determined by the hydraulic system (no operator control).

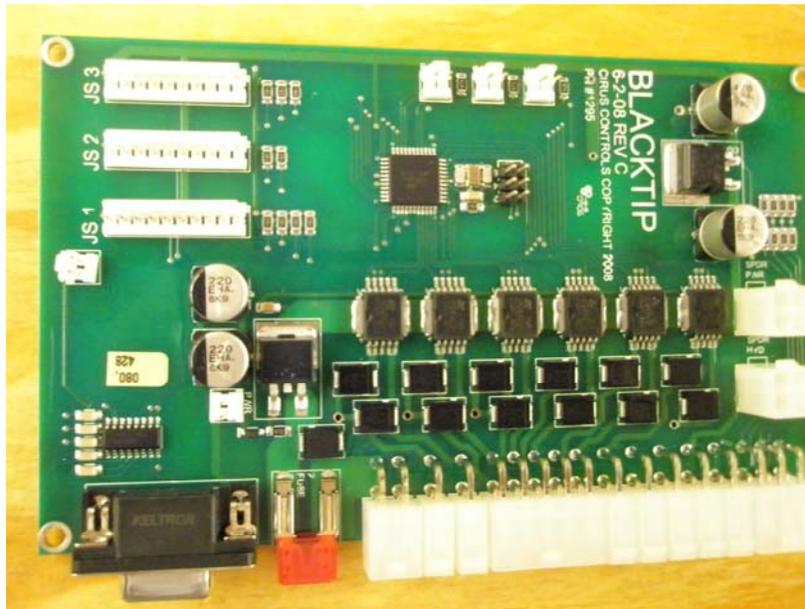
Minimum Trim: the minimum signal voltage delivered to the coil necessary to result in enough flow of hydraulic fluid to begin to move the implement selected.

Maximum Trim: the maximum signal voltage delivered to the coil necessary to result in enough flow of hydraulic fluid to reach the maximum speed of motion of the implement intended.

Appendix C – Standard and Optional System Drawings

Joystick Interconnection

Use this image of the Joystick board and the table below to verify joysticks are plugged into correct ports.

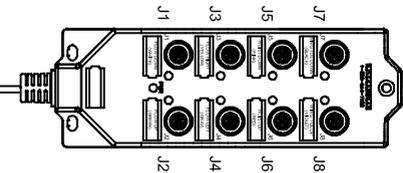
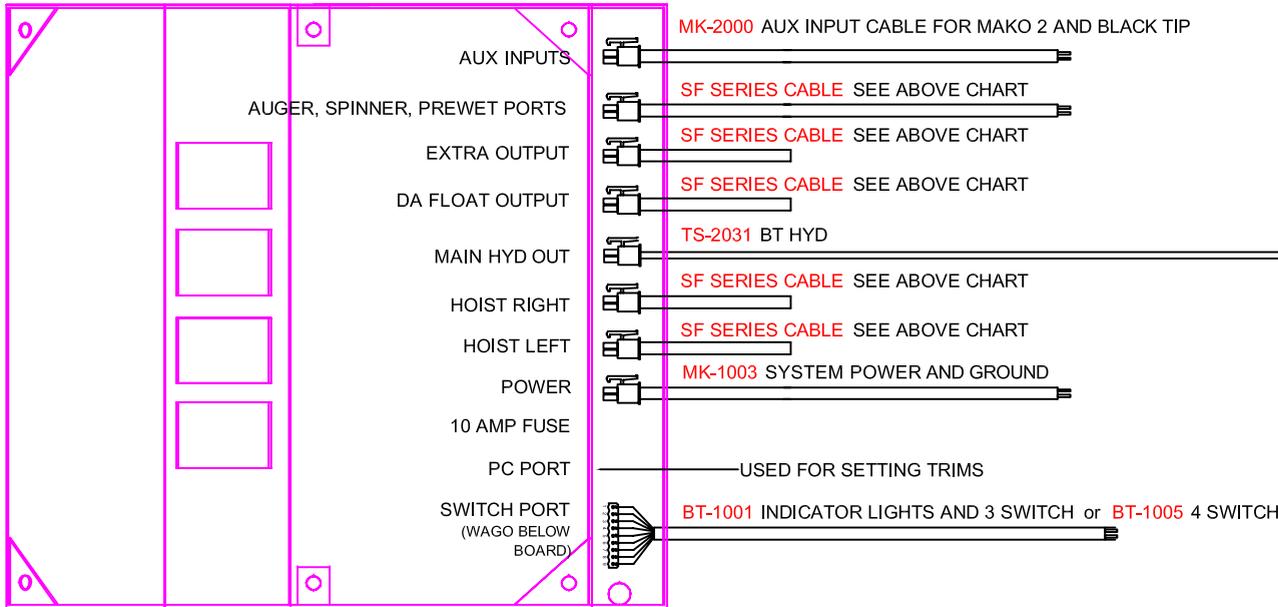


JOYSTICK OPTIONS:

- 848 DUAL AXIS HFX JOYSTICK
- 846 SINGLE AXIS HFX JOYSTICK

SF SERIES CABLE OPTIONS

- SF-1000 MOLEX TO DIN
- SF-1002 MOLEX TO ITT CANNON
- SF-1003 MOLEX TO WEATHERPACK



VALVE PIGTAIL OPTIONS

- TS-2010 M12 TO WEATHERPACK
- TS-2011 M12 TO AMP JUNIOR TIMER
- TS-2012 M12 TO AMP
- TS-2013 M12 TO ITT CANNON
- TS-2014 M12 TO DIN

BLACK TIP SHEETMETAL (PN 978) TOP VIEW

INTERNAL CABLES

- BT-1000 INTERNAL 2 INDICATOR AND 3 SWITCH WIRING
- BT-1002 JUMPER CABLE FROM EZ SPREAD TO BLACK TIP
- BT-1003 JUMPER CABLE FROM SPREAD DR OR DUAL SPREAD TO BLACK TIP
- BT-1004 INTERNAL 4 SWITCH WIRING

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CIRUS
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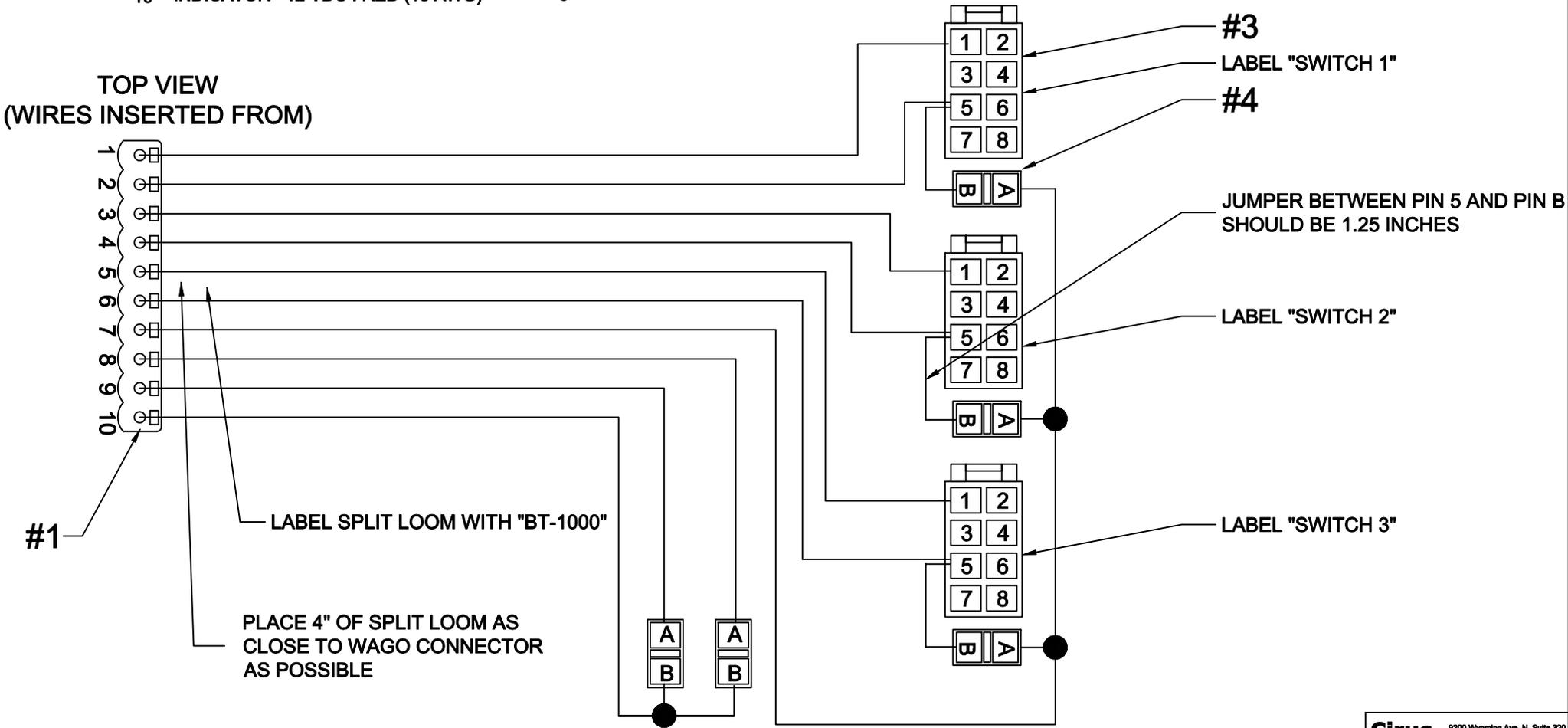
9210 WYOMING AVE. N. SUITE 200
BROOKLYN PARK, MN 55445

REV	DATE	DESCRIPTION				
A	-	-	BLACK TIP CONTROL SYSTEM			
B	-	-				
C	-	-				
D	-	-				
E	-	-				
			CABLE OVERVIEW			
DESIGN:	DRAWN:	AS BUILT:	PROJECT NUMBER:	SCALE:	DATE:	REV.
JTM	JTM	-	BLACK TIP-OV	NONE	7-26-05	-
					SHT 1 OF 1	

B.O.M.

PIN#	SIGNAL	LENGTH	#	QTY	PART NUMBER	DESCRIPTION
1	SWITCH 1 POWER : ORANGE (18 AWG)	8"	1	1	231-640 /019-000	10 PIN WAGO BULKHEAD RECEPTACLE
2	SWITCH 1 OUTPUT : RED (18 AWG)	8"	2	16	SPC-2004	FEMALE SPADES FOR SPRAGUE PLUGS
3	SWITCH 2 POWER : GREEN (18 AWG)	8"	3	3	SP596.289	SPRAGUE PLUG FOR SWITCH
4	SWITCH 2 OUTPUT : RED (18 AWG)	8"	4	5	SP913.328	SPRAGUE PLUG FOR LIGHT
5	SWITCH 3 POWER : YELLOW (18 AWG)	8"	5	4 in	LCP-413	SPLIT LOOM
6	SWITCH 3 OUTPUT : RED (18 AWG)	8"				
7	GROUND : BLACK (18 AWG)	8"				
8	INDICATOR 1 : BLUE (18 AWG)	8"				
9	INDICATOR 2 : PURPLE (18 AWG)	8"				
10	INDICATOR +12 VDC : RED (18 AWG)	8"				

TOP VIEW
(WIRES INSERTED FROM)



CABLE # BT-1000

Cirus Controls
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 Brooklyn Park, MN 55445
 Tel: (763) 493-9380
 Fax: (763) 493-9340

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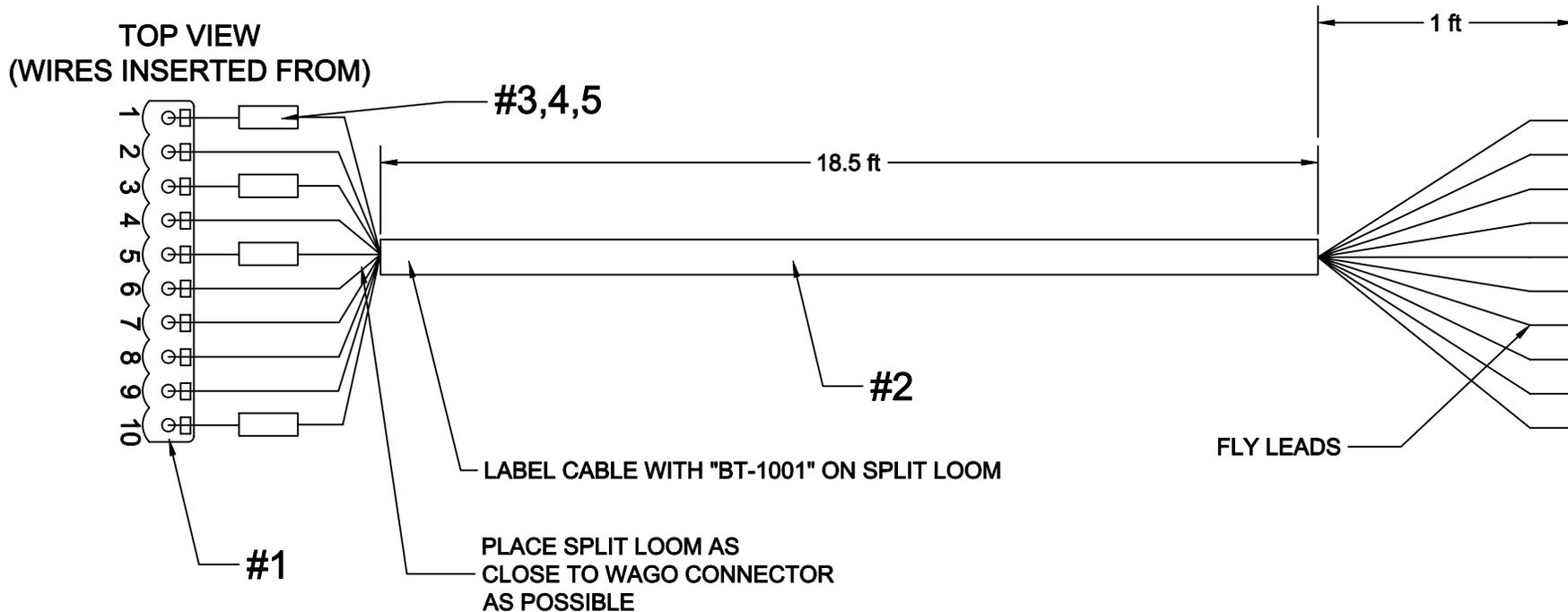
REV	DATE	DESCRIPTION	PROJECT NUMBER	SCALE	DATE	REV
A	7-15-05	ADDED CABLE NAME TO CABLE	BT-1000	NONE	7-15-05	A
B	-	-				
C	-	-				
D	-	-				
E	-	-				

DESIGN: JTM DRAWING: JTM AS BUILT: -

INDICATOR AND SWITCH WIRING
 BLACK TIP (ONE TON)
 SHW 1 OF 1

B.O.M.

PIN#	SIGNAL	LENGTH	#	QTY	PART NUMBER	DESCRIPTION
1	SWITCH 1 POWER : ORANGE (18 AWG)	20 ft	1	1	231-310 /037-000	10 PIN WAGO PLUG WITH LOCKING TABS
2	SWITCH 1 OUTPUT : RED (18 AWG)	20 ft	2	18.5 ft	LCP-413	SPLIT LOOM
3	SWITCH 2 POWER : GREEN (18 AWG)	20 ft	3	4	WAYTEK 46025	10 AMP IN LINE FUSE HOLDER
4	SWITCH 2 OUTPUT : RED (18 AWG)	20 ft	4	4	WAYTEK 46026	10 AMP IN LINE FUSE HOLDER COVER
5	SWITCH 3 POWER : YELLOW (18 AWG)	20 ft	5	4	WAYTEK 46256	10 AMP FUSE
6	SWITCH 3 OUTPUT : RED (18 AWG)	20 ft				
7	GROUND : BLACK (18 AWG)	20 ft				
8	INDICATOR 1 : BLUE (18 AWG)	20 ft				
9	INDICATOR 2 : PURPLE (18 AWG)	20 ft				
10	INDICATOR +12 VDC : RED (18 AWG)	20 ft				



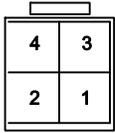
NOTES:
 1. LABEL WIRE WITH SIGNAL NAME EVERY 12 INCHES

CABLE # BT-1001

Cirus Controls
 8200 Wyoming Ave. N, Suite 320
 Brooklyn Park, MN 55445
 Tel: (763) 493-9390
 Fax: (763) 493-9340

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REV	DATE	DESCRIPTION	BLACK TIP (ONE TON)		
A	7-16-08	ADDED CABLE NUMBER TO CABLE	EXTERNAL INDICATOR AND SWITCH WIRING		
B	-	-			
C	-	-			
D	-	-			
E	-	-			
DESIGN	JTM	DRAWING	JTM	AS BUILT:	-
PROJECT NUMBER	BT-1001	SCALE	NONE	DATE: 7-15-08	REV. A
			SHT 1 OF 1		



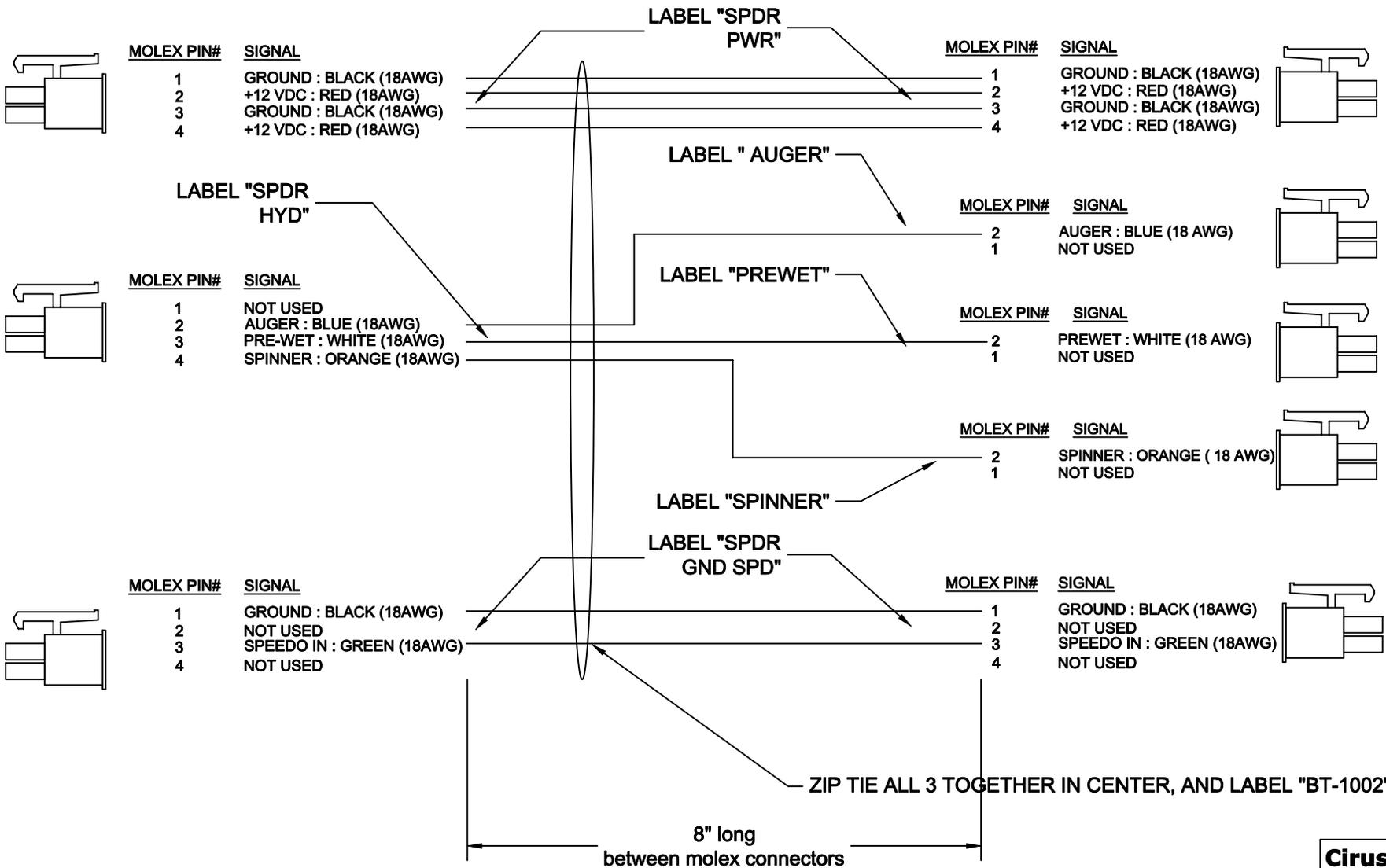
BACK VIEW
(SIDE PINS ARE INSERTED FROM)



BACK VIEW
(SIDE PINS ARE INSERTED FROM)

B.O.M.

#	QTY	PART NUMBER	DESCRIPTION
1	5	39-01-2040 OR WM3701-ND	4 PIN MOLEX PLUG WITH LOCK
2	3	39-01-2020 OR WM3700-ND	2 PIN MOLEX WITH LOCK
3	18	39-00-0039 OR WM2501-ND	MOLEX SOCKETS FOR PLUGS



CABLE # BT-1002

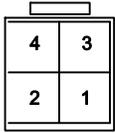
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REV	DATE	DESCRIPTION
A	-	-
B	-	-
C	-	-
D	-	-
E	-	-

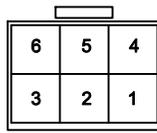
DESIGN: JTM	DRAWING: JTM	AS BUILT: -	PROJECT NUMBER: BT-1002	SCALE: NONE	DATE: 7-15-05	REV: -
SHT 1 OF 1						

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Tel: (763) 493-9390
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BLACK TIP (ONE TON)
EZ SPREAD INTERNAL JUMPER



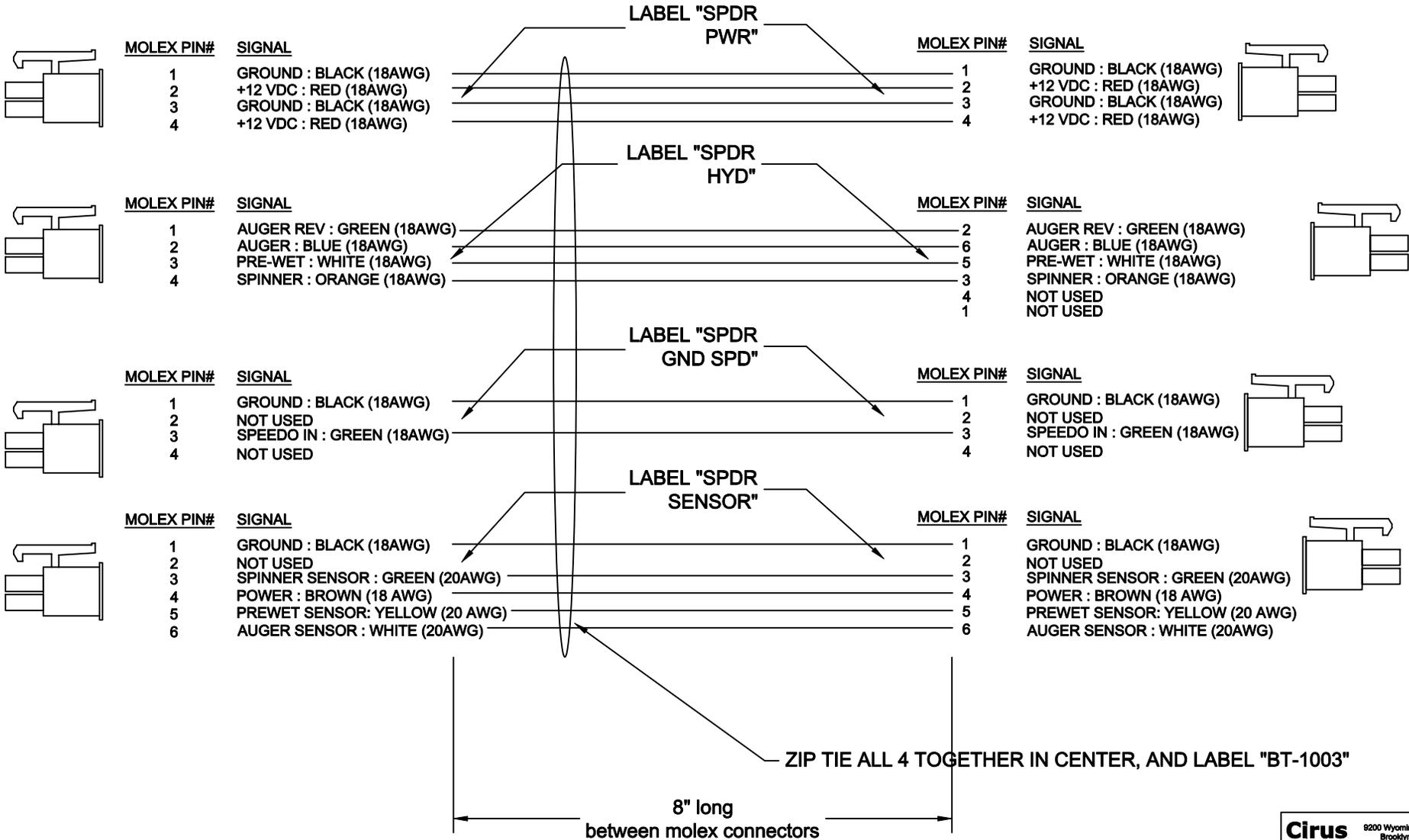
BACK VIEW
(SIDE PINS ARE INSERTED FROM)



BACK VIEW
(SIDE PINS ARE INSERTED FROM)

B.O.M.

#	QTY	PART NUMBER	DESCRIPTION
1	5	39-01-2040 OR WM3701-ND	4 PIN MOLEX PLUG WITH LOCK
2	3	39-01-2060 OR WM3702-ND	6 PIN MOLEX PLUG WITH LOCK
3	30	39-00-0039 OR WM2501-ND	MOLEX SOCKETS FOR PLUGS



CABLE # BT-1003

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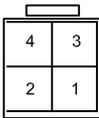
REV	DATE	DESCRIPTION	PROJECT NUMBER			SCALE	DATE	REV.
A	-	-	BT-1003			NONE	7-18-05	-
B	-	-						
C	-	-						
D	-	-						
E	-	-						
F	-	-						

DESIGN: JTM DRAWING: JTM AS BUILT: -

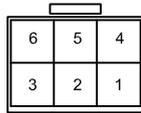
Cirus Controls 8200 Wyoming Ave. N. Suite 320
Brooklyn Park, MN 55445
Tel: (763) 493-9380
Fax: (763) 493-9340

BLACK TIP (ONE TON)
DS & SPREAD DR INTERNAL JUMPER

SHT 1 OF 1



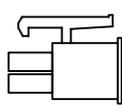
BACK VIEW
(SIDE PINS ARE INSERTED FROM)



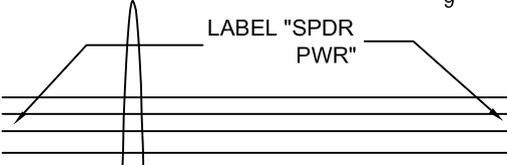
BACK VIEW
(SIDE PINS ARE INSERTED FROM)

B.O.M.

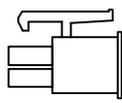
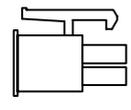
QTY	PART NUMBER	DESCRIPTION
4	39-01-2040 OR WM3701-ND	4 PIN MOLEX PLUG WITH LOCK
2	39-01-2060 OR WM3702-ND	6 PIN MOLEX PLUG WITH LOCK
25	39-00-0039 OR WM2501-ND	MOLEX SOCKETS FOR PLUGS
1	39-01-2041 OR WM3601-ND	4 PIN MOLEX RECEPTICAL
1	39-01-2061 OR WM3602-ND	6 PIN MOLEX RECEPTICAL
9	39-00-0041 OR WM2500-ND	MOLEX PINS FOR RECEPTICAL



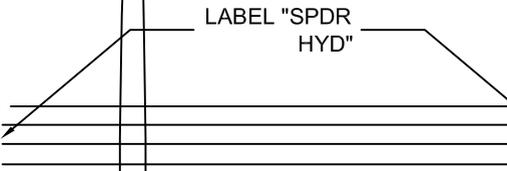
MOLEX PIN#	SIGNAL
1	GROUND : BLACK (18AWG)
2	+12 VDC : RED (18AWG)
3	GROUND : BLACK (18AWG)
4	+12 VDC : RED (18AWG)



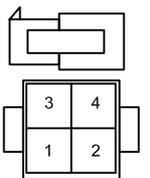
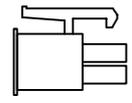
MOLEX PIN#	SIGNAL
1	GROUND : BLACK (18AWG)
2	+12 VDC : RED (18AWG)
3	GROUND : BLACK (18AWG)
4	+12 VDC : RED (18AWG)



MOLEX PIN#	SIGNAL
1	AUGER REV : GREEN (18AWG)
2	AUGER : BLUE (18AWG)
3	PRE-WET : WHITE (18AWG)
4	SPINNER : ORANGE (18AWG)

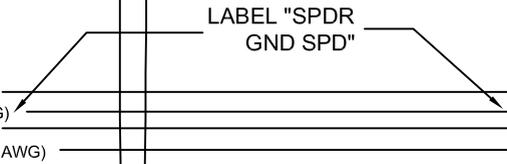


MOLEX PIN#	SIGNAL
2	AUGER REV : GREEN (18AWG)
6	AUGER : BLUE (18AWG)
5	PRE-WET : WHITE (18AWG)
3	SPINNER : ORANGE (18AWG)
4	NOT USED
1	NOT USED

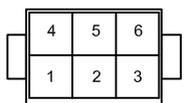
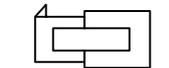
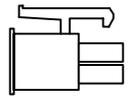


BACK VIEW
(SIDE PINS ARE INSERTED FROM)

MOLEX PIN#	SIGNAL
1	GROUND : WHITE (18AWG)
2	REMOTE PASS : BLUE (18 AWG)
3	SPEEDO IN : GREEN (18AWG)
4	REMOTE BLAST : ORANGE (18 AWG)

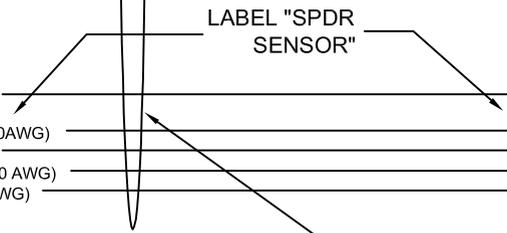


MOLEX PIN#	SIGNAL
1	GROUND : WHITE (18AWG)
2	REMOTE PASS : BLUE (18AWG)
3	SPEEDO IN : GREEN (18AWG)
4	REMOTE BLAST : ORANGE (18AWG)

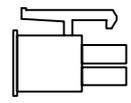


BACK VIEW
(SIDE PINS ARE INSERTED FROM)

MOLEX PIN#	SIGNAL
1	GROUND : BLACK (18AWG)
2	NOT USED
3	SPINNER SENSOR : GREEN (20AWG)
4	POWER : BROWN (18 AWG)
5	PREWET SENSOR: YELLOW (20 AWG)
6	AUGER SENSOR : WHITE (20AWG)



MOLEX PIN#	SIGNAL
1	GROUND : BLACK (18AWG)
2	NOT USED
3	SPINNER SENSOR : GREEN (20AWG)
4	POWER : BROWN (18 AWG)
5	PREWET SENSOR: YELLOW (20 AWG)
6	AUGER SENSOR : WHITE (20AWG)



ZIP TIE ALL 4 TOGETHER IN CENTER, AND LABEL "BT-2003"

18" long
between molex connectors

CABLE # BT-2003

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REV	DATE	DESCRIPTION
A	-	-
B	-	-
C	-	-
D	-	-

DESIGN	DRAWN	AS BUILT	PROJECT NUMBER	SCALE	DATE	REV.
JTM	JTM	-	BT-2003	NONE	15-10-08	-

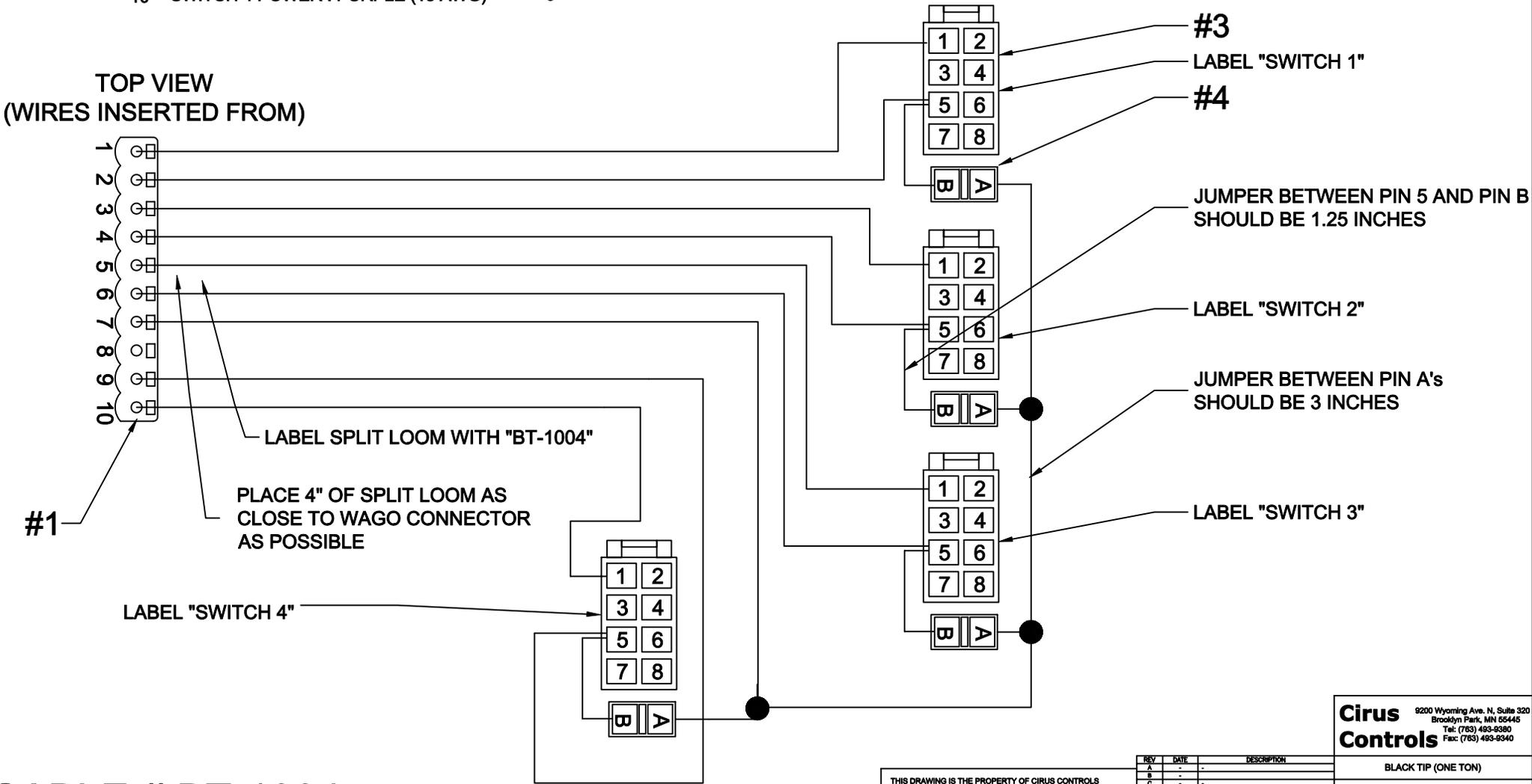
BLACK TIP (ONE TON)	
EZ, DS, & SPREAD DR INTERNAL JUMPER	

Cirus Controls
9210 Wyoming Ave. N. Suite 200
Brooklyn Park, MN 55445
Tel: (763) 493-9380
Fax: (763) 493-9340

B.O.M.

PIN#	SIGNAL	LENGTH	#	QTY	PART NUMBER	DESCRIPTION
1	SWITCH 1 POWER : ORANGE (18 AWG)	9"	1	1	231-640 /019-000	10 PIN WAGO BULKHEAD RECEPTACLE
2	SWITCH 1 OUTPUT : RED (18 AWG)	9"	2	16	SPC-2004	FEMALE SPADES FOR SPRAGUE PLUGS
3	SWITCH 2 POWER : GREEN (18 AWG)	9"	3	3	SP596.289	SPRAGUE PLUG FOR SWITCH
4	SWITCH 2 OUTPUT : RED (18 AWG)	9"	4	5	SP913.328	SPRAGUE PLUG FOR LIGHT
5	SWITCH 3 POWER : YELLOW (18 AWG)	9"	5	4 in	LCP-413	SPLIT LOOM
6	SWITCH 3 OUTPUT : RED (18 AWG)	9"				
7	GROUND : BLACK (18 AWG)	9"				
8	NOT USED					
9	SWITCH 4 OUTPUT: RED (18 AWG)	9"				
10	SWITCH 4 POWER : PURPLE (18 AWG)	9"				

TOP VIEW
(WIRES INSERTED FROM)



CABLE # BT-1004

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REV	DATE	DESCRIPTION
A	-	-
B	-	-
C	-	-
D	-	-
E	-	-

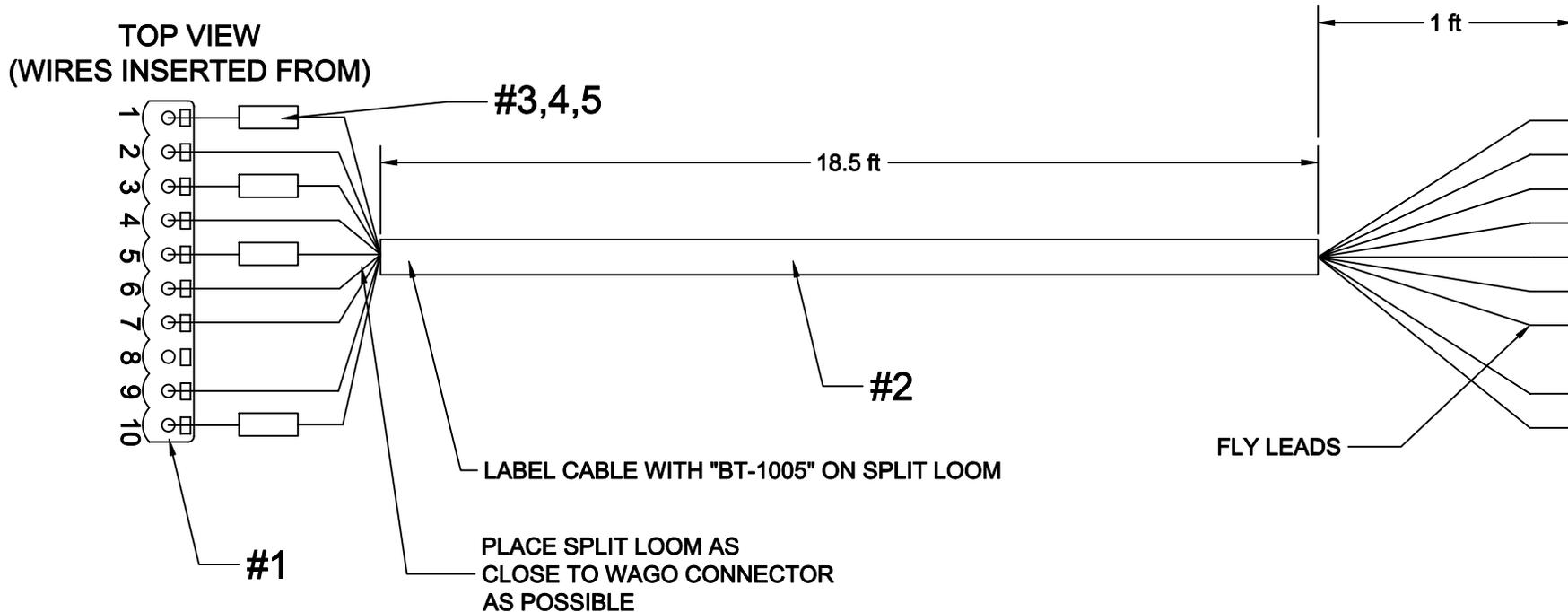
DESIGN: JTM	DRAWING: JTM	AS BUILT: -	PROJECT NUMBER: BT-1004	SCALE: NONE	DATE: 7-20-08	REV: -
			BLACK TIP (ONE TON)		SWITCH WIRING	
			SHT 1 OF 1			

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Fax: (763) 493-9340

B.O.M.

PIN#	SIGNAL	LENGTH
1	SWITCH 1 POWER : ORANGE (18 AWG)	20 ft
2	SWITCH 1 OUTPUT : RED (18 AWG)	20 ft
3	SWITCH 2 POWER : GREEN (18 AWG)	20 ft
4	SWITCH 2 OUTPUT : RED (18 AWG)	20 ft
5	SWITCH 3 POWER : YELLOW (18 AWG)	20 ft
6	SWITCH 3 OUTPUT : RED (18 AWG)	20 ft
7	GROUND : BLACK (18 AWG)	20 ft
8	NOT USED	
9	SWITCH 4 OUTPUT : RED (18 AWG)	20 ft
10	SWITCH 4 POWER : PURPLE (18 AWG)	20 ft

#	QTY	PART NUMBER	DESCRIPTION
1	1	231-310 /037-000	10 PIN WAGO PLUG WITH LOCKING TABS
2	18.5 ft	LCP-413	SPLIT LOOM
3	4	WAYTEK 46025	10 AMP IN LINE FUSE HOLDER
4	4	WAYTEK 46026	10 AMP IN LINE FUSE HOLDER COVER
5	4	WAYTEK 46256	10 AMP FUSE



NOTES:
 1. LABEL WIRE WITH SIGNAL NAME EVERY 12 INCHES

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BLACK TIP (ONE TON)

EXTERNAL SWITCH WIRING

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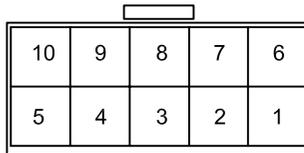
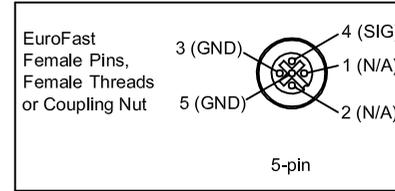
REV	DATE	DESCRIPTION
A	-	-
B	-	-
C	-	-
D	-	-
E	-	-

DESIGN: JTM	DRAWING: JTM	AS BUILT: -	PROJECT NUMBER: BT-1005	SCALE: NONE	DATE: 7-20-05	REV: -
			SHT 1 OF 1			

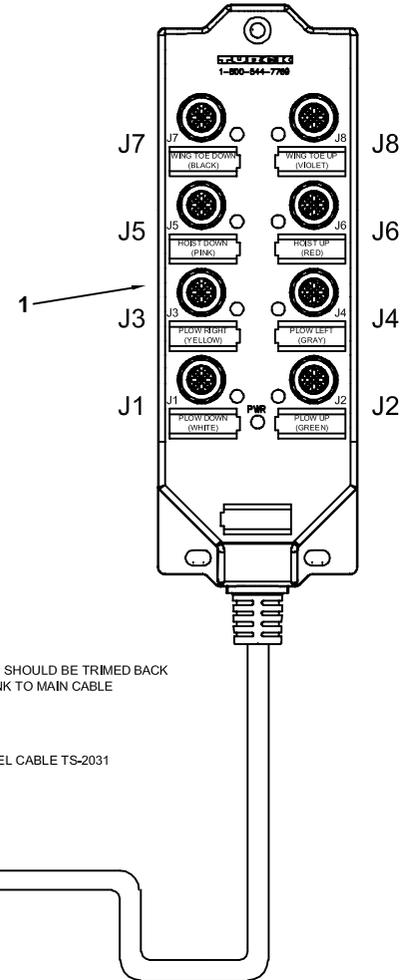
CABLE # BT-1005

B.O.M.

QTY	PART NUMBER	DESCRIPTION
1	8MB12Z-4P2-5	8 TERMINAL TURCK BOX 15' CABLE
1	39-01-2100 (Digi-Key WM3704-ND)	MOLEX RECEPTACLE 10 PIN
10	39-00-0039 (Digi-Key WM2501-ND)	MOLEX TERMINALS FEMALE 18-24 AWG



BACK VIEW
(SIDE PINS ARE INSERTED FROM)



MOLEX PIN#	BT108 HYD	BT210 HYD	MAKO II HYD A	MAKO II HYD B	SPREADER	COLOR (PORT#)
10	PLOW DOWN	PLOW DOWN	PLOW DOWN	HEEL DOWN	SPINNER FWD	WHITE (J1)
9	PLOW RIGHT	LT WING IN	PLOW RIGHT	SLIDE OUT	SPINNER REV	YELLOW (J3)
8	HOIST DOWN	HOIST DOWN	HOIST DOWN	BLADE DOWN	ANT-ICE	PINK (J5)
7	GND	GND	GND	GND	GND	BLUE
6	SPINNER	RT WING IN	TOE DOWN	BLADE RIGHT	NOT USED	BLACK (J7)
5	PLOW UP	PLOW UP	PLOW UP	HEEL UP	AUGER FWD	GREEN (J2)
4	PLOW LEFT	LT WING OUT	PLOW LEFT	SLIDE IN	AUGER REV	GRAY (J4)
3	HOIST UP	HOIST UP	HOIST UP	BLADE UP	PRE-WET	RED (J6)
2	GND	GND	GND	GND	GND	GREEN / YELLOW
1	AUGER	RT WING OUT	TOE UP	BLADE LEFT	NOT USED	VIOLET (J8)

CABLE # TS-2031

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REV	DATE	DESCRIPTION
A	4-16-08	ADDED MAKO II OUTPUTS
B	12-30-09	ADDED AUGER / SPINNER OUTPUTS
C	-	-
D	-	-
E	-	-

DESIGN:	DRAWN:	AS BUILT:	PROJECT NUMBER:	SCALE:	DATE:	REV.
JTM	JTM	-	TS-2031	NONE	4-16-08	B

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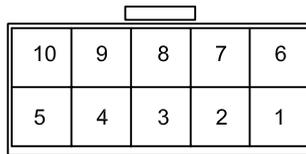
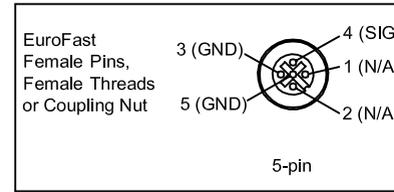
BLACK TIP CABLES

VALVE JUNCTION BOX 8 PORT

SHT 1 OF 1

B.O.M.

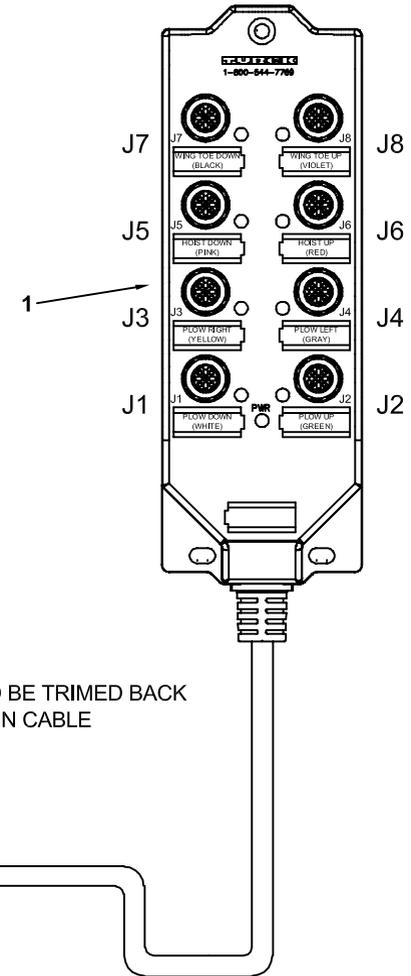
QTY	PART NUMBER	DESCRIPTION
1	8MB12Z-4P2-5	8 TERMINAL TURCK BOX 15' CABLE
1	39-01-2100	MOLEX RECEPTACLE 10 PIN
10	39-00-0039	MOLEX TERMINALS FEMALE 18-24 AWG
2	39-01-2020	MOLEX RECEPTACLE 2 PIN



BACK VIEW
(SIDE PINS ARE INSERTED FROM)



BACK VIEW
(SIDE PINS ARE INSERTED FROM)



10 PIN MOLEX PIN#	BT110/210 STD	BT108 HOOK	BT108 V-PLOW	COLOR (PORT#)
10	PLOW DOWN	PLOW DOWN	PLOW DOWN	WHITE (J1)
9	PLOW RIGHT	PLOW RIGHT	LT WING IN	YELLOW (J3)
8	HOIST DOWN	HOIST DOWN	HOIST DOWN	PINK (J5)
7	GND	GND	GND	BLUE
5	PLOW UP	PLOW UP	PLOW UP	GREEN (J2)
4	PLOW LEFT	PLOW LEFT	LT WING OUT	GRAY (J4)
3	HOIST UP	HOIST UP	HOIST UP	RED (J6)
2	GND	GND	GND	GREEN / YELLOW

2 PIN MOLEX PIN#				COLOR (PORT#)
2	SPINNER	HOIST RIGHT	RT WING IN	BLACK (J7)
2	AUGER	HOIST LEFT	RT WING OUT	VIOLET or ORANGE (J8)

NOTES:

1. WIRE COLORS MAY CHANGE SO ALWAYS GO OFF OF MOLEX PIN NUMBERS AND "J" PORT NUMBERS.

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REV	DATE	DESCRIPTION
A	-	-
B	2-2-10	added spinner and auger 2 pin option
C	-	-
D	-	-
E	-	-

DESIGN: JTM	DRAWN: JTM	AS BUILT: -	PROJECT NUMBER: TS-2032	SCALE: NONE	DATE: 9-28-05	REV. B
					SHT 1 OF 1	

Cirus Controls
9200 Wyoming Ave. N, Suite 320
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Tel: (763) 493-9380
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BLACK TIP CABLES

VALVE JUNCTION BOX 8 PORT

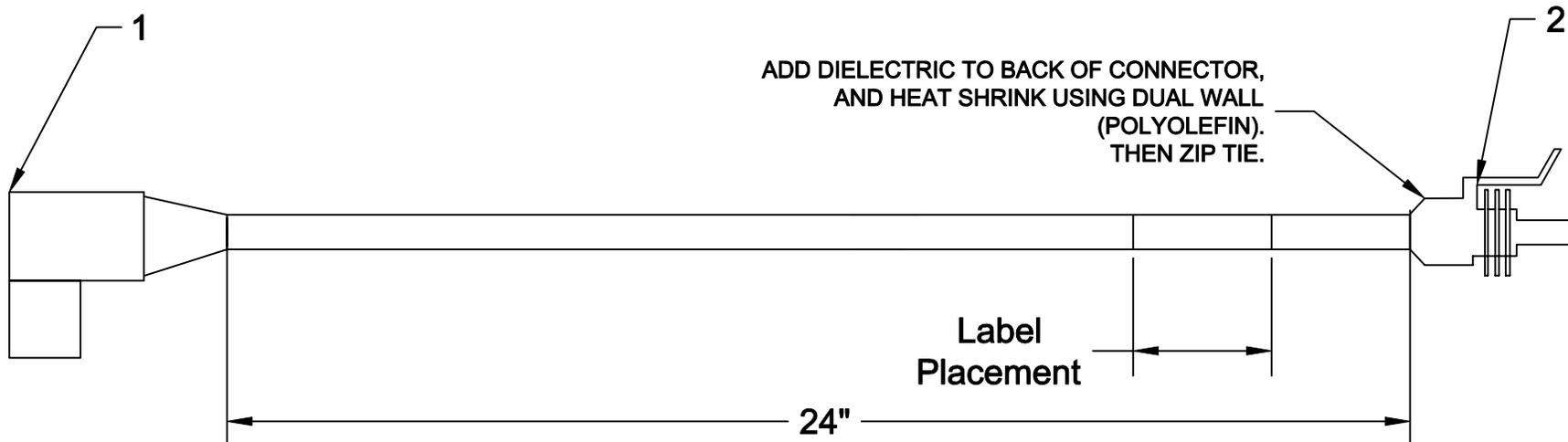
CABLE # TS-2032

WIRING DIAGRAM

M12	WP
1	
2	
3	1
4	2

B.O.M.

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	WS 4T - .5	M12 90 degree connector and cable
2	1	38043 (waytek)	weatherpack 2 pin (tower half)
3	2	30035 (waytek)	tower terminals 20- 18 awg
4	2	39000 (waytek)	weatherpack seals



Notes:

- 18 AWG, 2 Conductor cable
- Label to be white w/ black printing and located on cable per drawing. (mylar w/ clear cover, all caps, 15pt font)
- M12 MATES TO SENSOR BOX 4MB12-4P2

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REV	DATE	DESCRIPTION			
A	3-16-05	ADDED HEAT SHRINK, AND DIELECTRIC NOTE	SPREADER CABLE SYSTEM		
B	-	-	M12 TO WEATHERPACK		
C	-	-			
D	-	-			
E	-	-			
DESIGN:	DRAWN:	AS BUILT:	PROJECT NUMBER:	SCALE:	DATE:
JTM	JTM	-	TS-2010	NONE	3-16-05
					REV. A
					SHT 1 OF 1

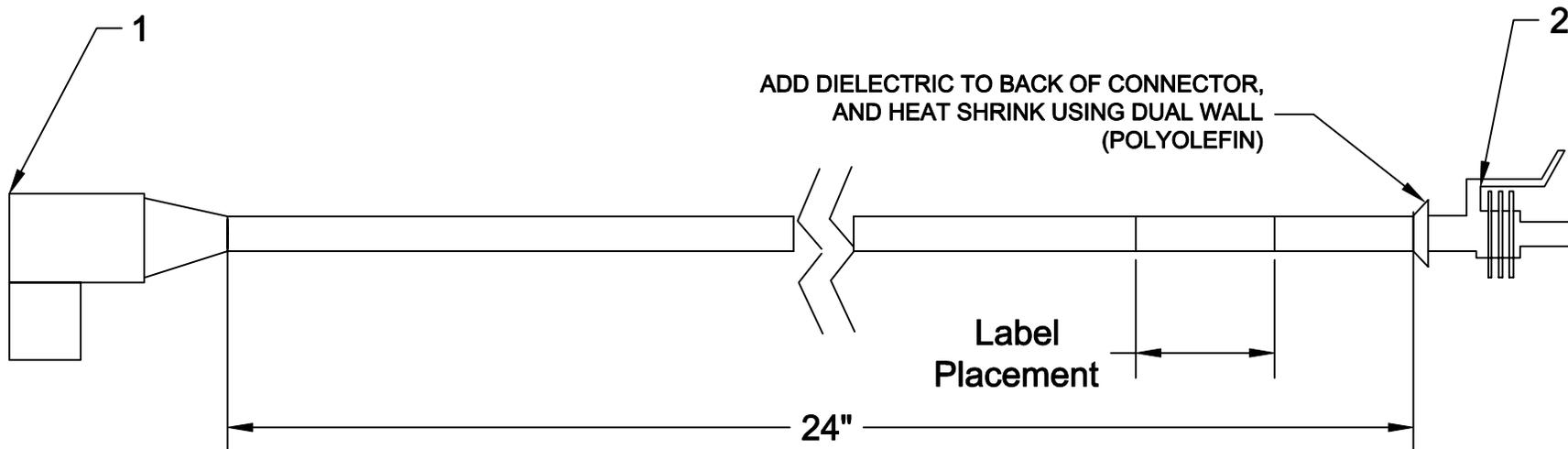
#TS-2010

WIRING DIAGRAM

M12	AMP
1	
2	
3	1
4	2

B.O.M.

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	????	M12 90 degree connector and cable
2	1	282189 - 1	AMP Junior Timer RECEPTACLE
3	2	929930 - 3	FEMALE TERMINAL for AMP Junior Timer
4	2	828905 - 1	18 AWG SEAL for AMP Junior Timer



Notes:

- 18 AWG, 2 Conductor cable
- Label to be white w/ black printing and located on cable per drawing. (mylar w/ clear cover, all caps, 15pt font)
- M12 MATES TO SENSOR BOX 4MB12-4P2

Cirus Controls 9200 Wyoming Ave. N, Suite 320
 Brooklyn Park, MN 55445
 Tel: (763) 493-9380
 Fax: (763) 493-9340

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REV	DATE	DESCRIPTION				
A	3-16-05	ADDED HEAT SHRINK NOTE				
B	-	-				
C	-	-				
D	-	-				
E	-	-				
DESIGN: JTM			DRAWN: JTM		AS BUILT: -	PROJECT NUMBER: TS-2011
					SCALE: NONE	DATE: 3-16-05
					SHT 1 OF 1	REV. A

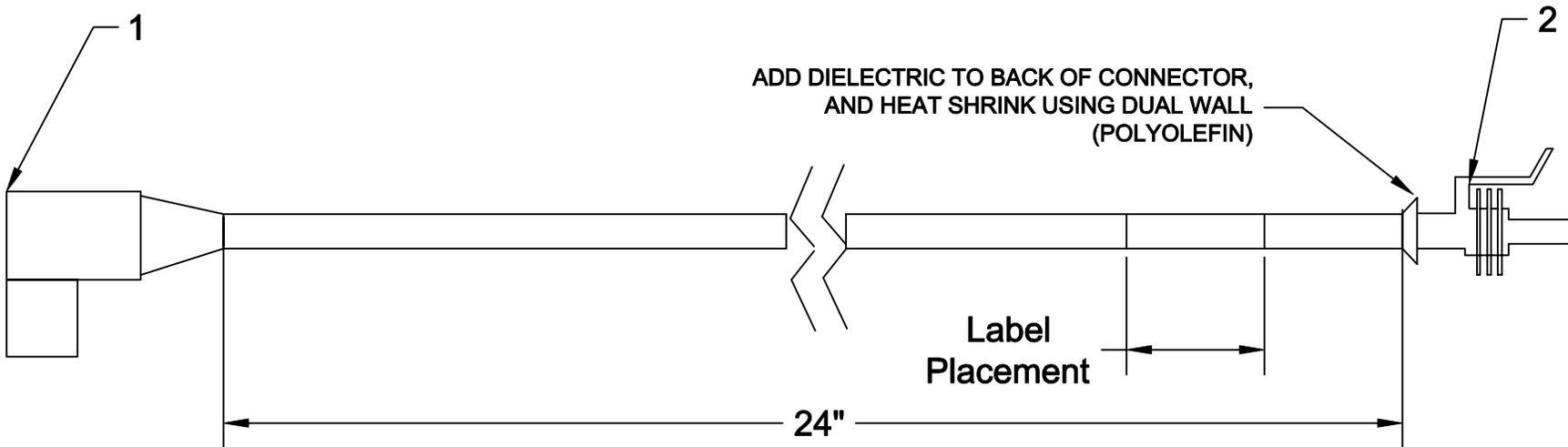
SPREADER CABLE SYSTEM

M12 TO AMP JR Timer

B.O.M.

WIRING DIAGRAM	
M12	AMP
1	
2	
3	1
4	2

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	????	M12 90 degree connector and cable
2	1	282080-1	AMP Superseal 1.5 RECEPTACLE
3	2	183025-1	FEMALE TERMINAL for Superseal 1.5
4	2	281934-2	18 AWG SEAL for Superseal 1.5



Notes:

- 18 AWG, 2 Conductor cable
- Label to be white w/ black printing and located on cable per drawing. (mylar w/ clear cover, all caps, 15pt font)
- M12 MATES TO SENSOR BOX 4MB12-4P2

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REV	DATE	DESCRIPTION			
A	3-16-05	ADDED HEAT SHRINK NOTE			
B	-	-			
C	-	-			
D	-	-			
E	-	-			
DESIGN: JTM		DRAWN: JTM		AS BUILT: -	PROJECT NUMBER: TS-2012
				SCALE: NONE	DATE: 3-16-05
				SHT 1 OF 1	REV. A

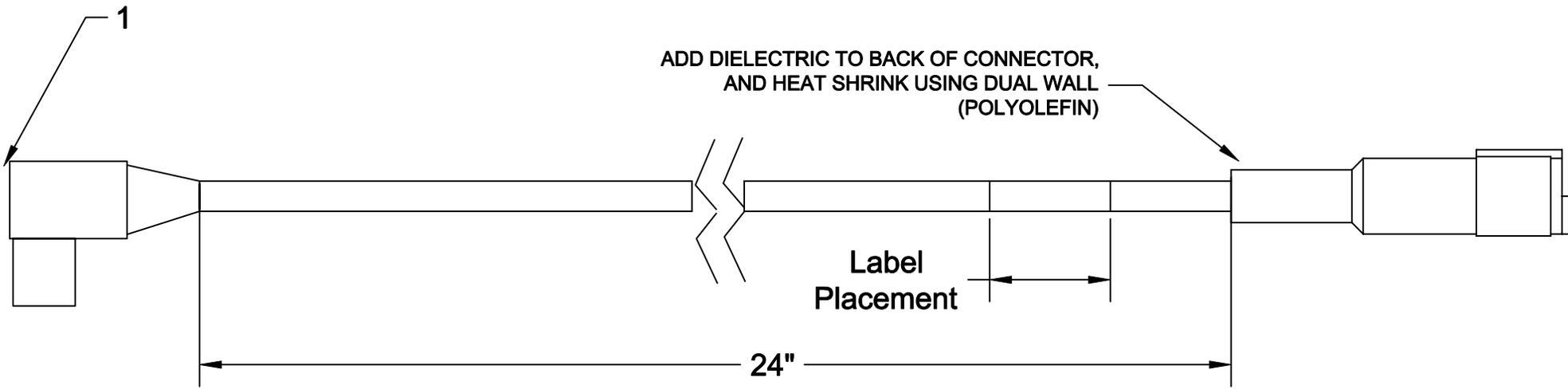
SPREADER CABLE SYSTEM

M12 TO AMP PLUG

B.O.M.

WIRING DIAGRAM	
M12	ITT
1	
2	
3	1
4	2

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	????	M12 connector and cable
2	1	317-1398-000	SURESEAL BOOT
3	1	120-1804-000	SURESEAL RECEPTACLE
4	1	031-1267-001	SURESEAL TIN SOCKET
5	1	030-2196-001	SURESEAL TIN PIN



Notes:

- 18 AWG, 2 Conductor cable
- Label to be white w/ black printing and located on cable per drawing. (mylar w/ clear cover, all caps, 15pt font)
- M12 MATES TO SENSOR BOX 4MB12-4P2

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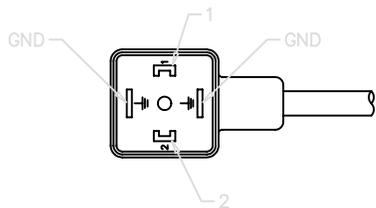
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REV	DATE	DESCRIPTION
A	3-16-05	ADDED HEAT SHRINK NOTE
B	-	-
C	-	-
D	-	-
E	-	-

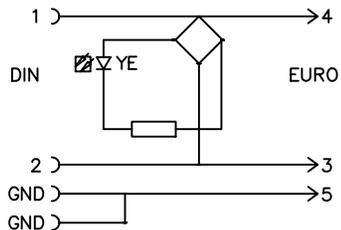
DESIGN: JTM DRAWN: JTM AS BUILT: -

SPREADER CABLE SYSTEM			
M12 TO ITT CANNON PLUG			
PROJECT NUMBER:	SCALE:	DATE:	REV.
TS-2013	NONE	3-16-05	A
SHT 1 OF 1			

DIN 43650 (FEMALE)



WIRING DIAGRAM

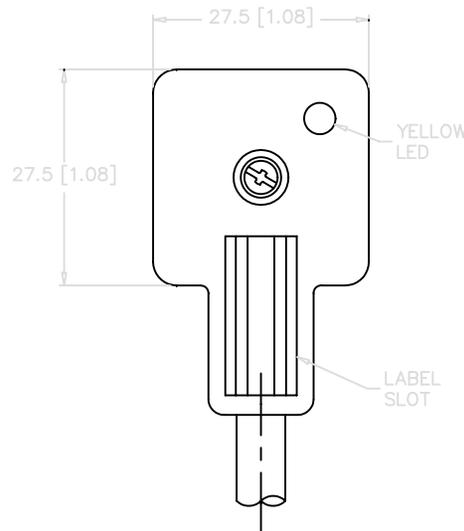
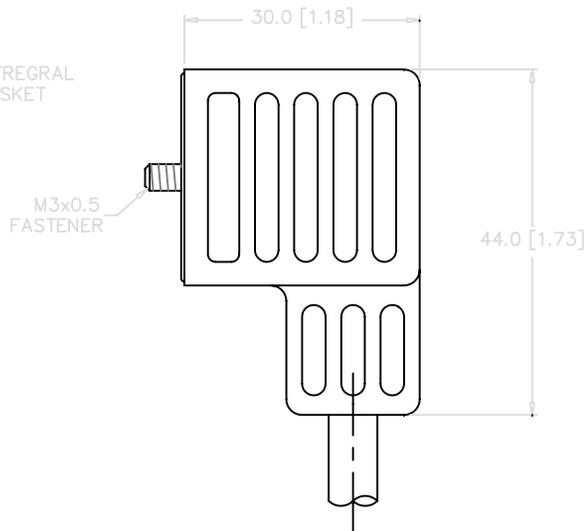
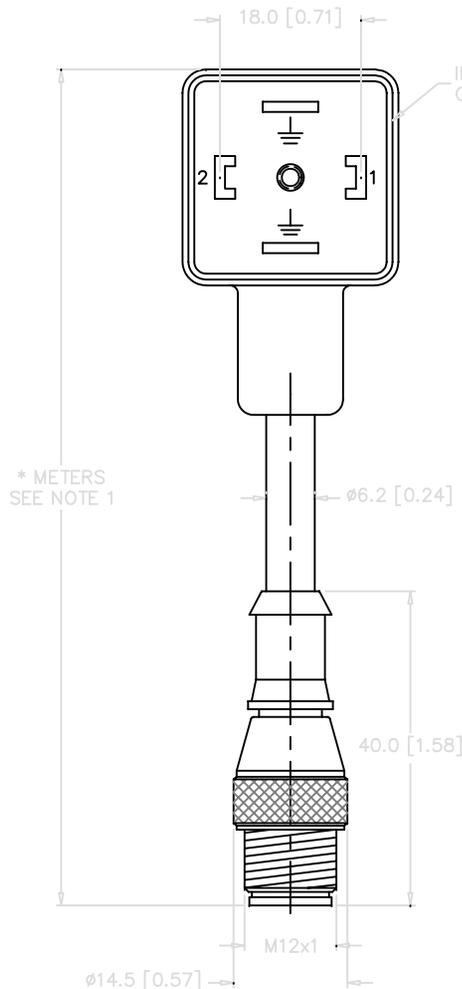


MALE END VIEW



SPECIFICATIONS

CONTACT CARRIER MATERIAL	NYLON OR PUR
CONTACT MATERIAL/PLATING (VALVE)	SILVER-PLATED BRASS
CONTACT MATERIAL/PLATING (EUROFAST)	GOLD-PLATED BRASS
MOLDED HEAD MATERIAL	POLYURETHANE
COUPLING NUT MATERIAL	NICKEL-PLATED BRASS
RATED CURRENT	4.0 A
RATED VOLTAGE	24-48 VAC/DC
OUTER JACKET MATERIAL/COLOR	PUR/GREY
NUMBER OF CONDUCTORS	3x18 AWG
CONDUCTOR INSULATION	PVC
TEMPERATURE RATING	-40°C to +105°C (-40°F to +221°F)
PROTECTION CLASS	MEETS NEMA 1,3,4,6P AND IEC IP67



SKETCH ONLY
NOT "OFFICIAL" TURCK DRAWING

CIRUS CABLE # TS-2014

SOURCE DRAWING - FOR REFERENCE ONLY

NOTES:
1. "*" INDICATES CABLE LENGTH IN METERS. CONTACT TURCK TO ORDER SPECIFIC LENGTHS.

RELATED DOCUMENTS		3RD ANGLE PROJECTION			
1. 2. 3. 4.					
MATERIAL		TOLERANCES UNLESS OTHERWISE SPECIFIED	DRFT	DATE	DESCRIPTION
FINISH			DSGN	SCALE	VAS 22-B653-0.6M-RS 5.3T
		UNIT OF MEASUREMENT		IDENTIFICATION NO.	
				<h2>TS-2014</h2>	
		DO NOT SCALE THIS DRAWING		FILE:	SHEET OF

REV	DESCRIPTION	BY	DATE	ECO NO.
A	DRAWING RELEASE	JB	02/11/03	

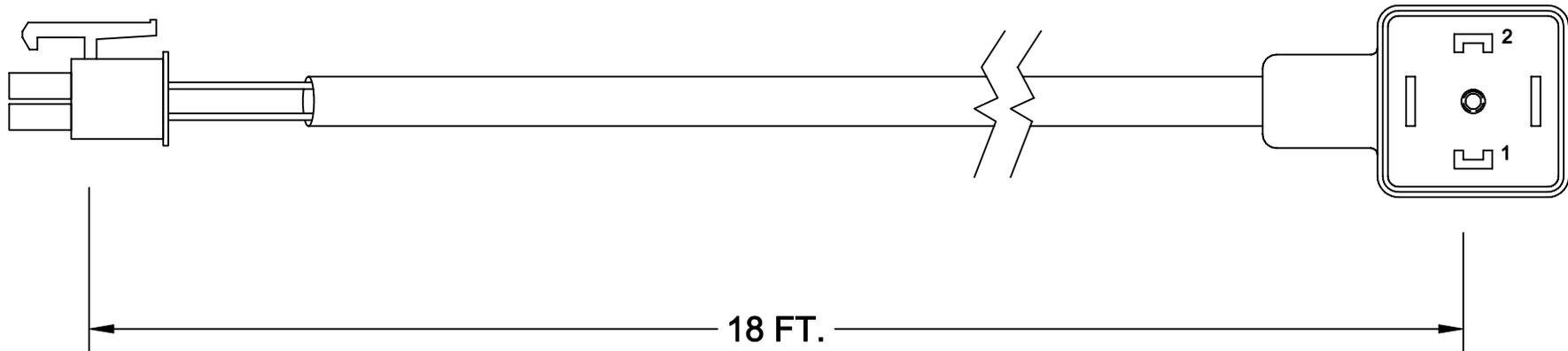
B.O.M.

QTY	PART NUMBER	DESCRIPTION
1	39-01-2020	MOLEX RECEPTACLE 2 PIN
2	39-00-0039	MOLEX TERMINALS FEMALE 18-24 AWG
18 FT	???	18 AWG, 2 COND. SVO CABLE or SIMILAR
1	43650	DIN CONNECTOR WITH INTEGRAL LED



BACK VIEW
(SIDE PINS ARE INSERTED FROM)

MOLEX PIN#	SIGNAL	DIN CONNECTOR PIN#
2	DRIVE : BLACK (18 AWG)	1
1	RETURN : WHITE (18AWG)	2



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REV	DATE	DESCRIPTION	SWORDFISH SPREADER CABLE SYSTEM										
A	-	-	EZ SPREAD HYDRAULIC CABLE										
B	-	-											
C	-	-											
D	-	-											
E	-	-											
DESIGN:	MVM	DRAWN:	MVM	AS BUILT:	-	PROJECT NUMBER:	SF-1000	SCALE:	NONE	DATE:	04-07-04	REV.:	-
											SHT 1 OF 1	-	

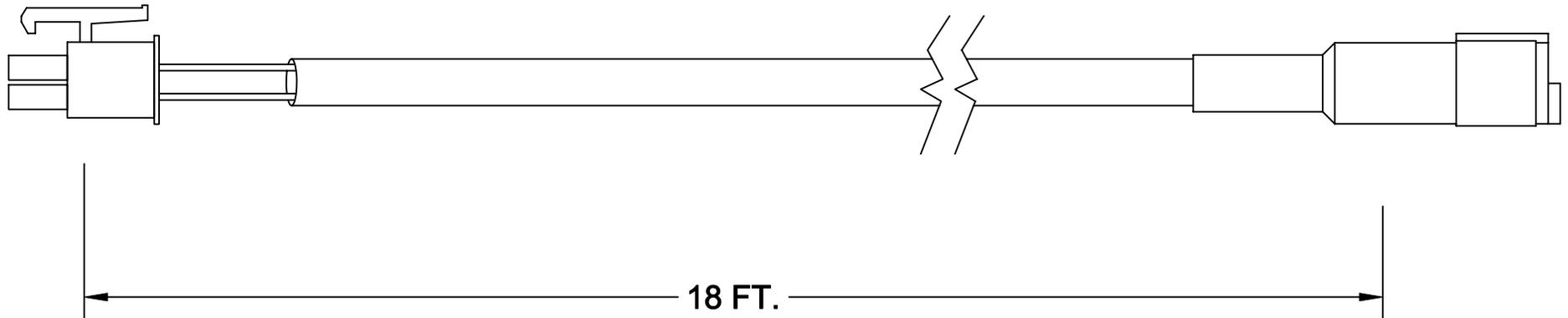
B.O.M.

QTY	PART NUMBER	DESCRIPTION
1	39-01-2020	MOLEX RECEPTACLE 2 PIN
2	39-00-0039	MOLEX TERMINALS FEMALE 18-24 AWG
18 FT	???	18 AWG, 2 COND. SVO CABLE or SIMILAR
1	317-1398-000	SURESEAL BOOT
1	120-1804-000	SURESEAL RECEPTACLE
1	031-1267-001	SURESEAL TIN SOCKET
1	030-2196-001	SURESEAL TIN PIN



BACK VIEW
(SIDE PINS ARE INSERTED FROM)

MOLEX PIN#	SIGNAL	C2 CONNECTOR PIN#
2	DRIVE : BLACK (18 AWG)	1
1	RETURN : WHITE (18AWG)	2



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REV	DATE	DESCRIPTION	SWORDFISH SPREADER CABLE SYSTEM										
A	-	-	EZ SPREAD HYDRAULIC CABLE										
B	-	-											
C	-	-											
D	-	-											
E	-	-											
DESIGN:	MVM	DRAWN:	MVM	AS BUILT:	-	PROJECT NUMBER:	SF-1002	SCALE:	NONE	DATE:	12-20-04	REV.:	-
											SHT 1 OF 1	-	

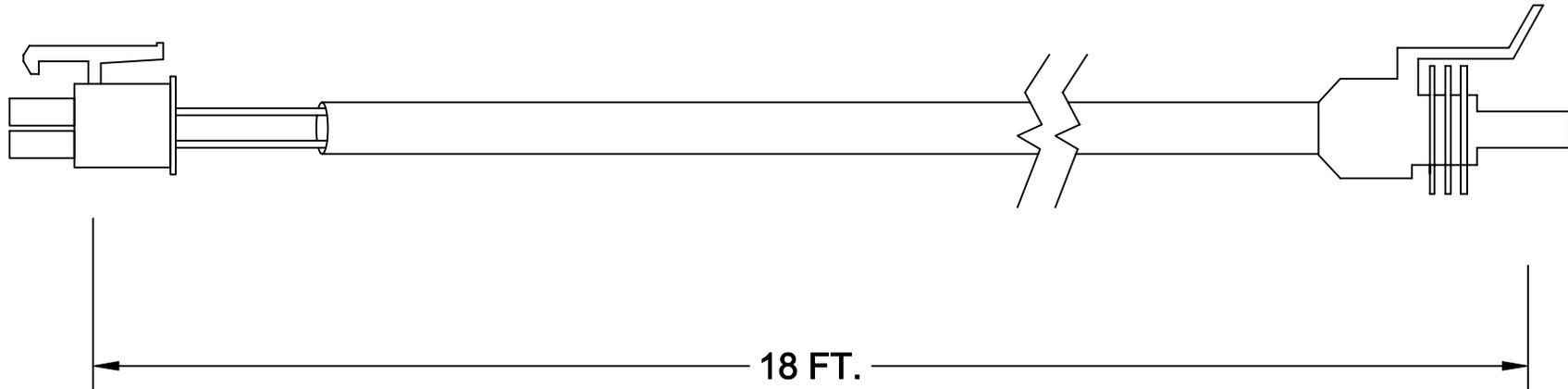
B.O.M.

QTY	PART NUMBER	DESCRIPTION
1	39-01-2020	MOLEX RECEPTACLE 2 PIN
2	39-00-0039	MOLEX TERMINALS FEMALE 18-24 AWG
18 FT	???	18 AWG, 2 COND. SVO CABLE or SIMILAR
1	38043 (WAYTEK)	WEATHERPAK 2 PIN (TOWER HALF)
2	30035 (WAYTEK)	TOWER TERMINALS 20-18 AWG
2	39000 (WAYTEK)	WEATHERPAK WIRE SEALS



BACK VIEW
(SIDE PINS ARE INSERTED FROM)

MOLEX PIN#	SIGNAL	AMP CONNECTOR PIN#
1	RETURN : WHITE (18AWG)	1
2	DRIVE : BLACK (18 AWG)	2

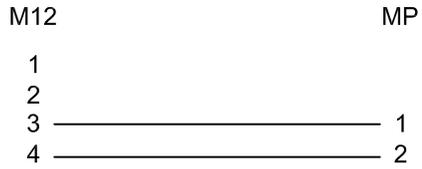


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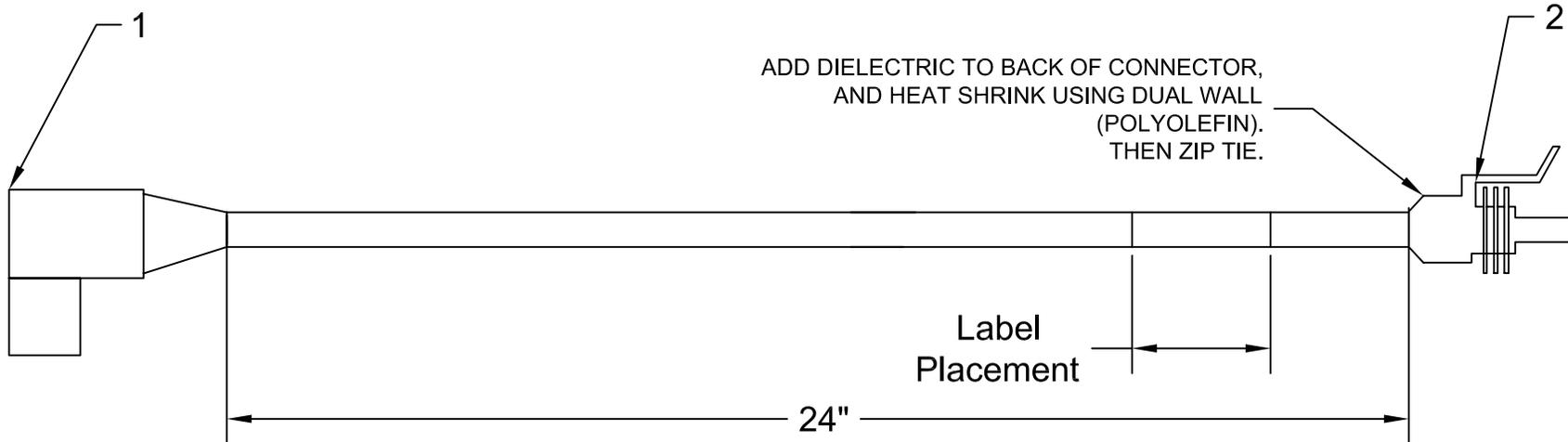
REV	DATE	DESCRIPTION	SWORDFISH SPREADER CABLE SYSTEM										
A	-	-	EZ SPREAD HYDRAULIC CABLE										
B	-	-											
C	-	-											
D	-	-											
E	-	-											
DESIGN:	MVM	DRAWN:	MVM	AS BUILT:	-	PROJECT NUMBER:	SF-1003	SCALE:	NONE	DATE:	01-07-05	REV.	-
											SHT 1 OF 1	-	

WIRING DIAGRAM



B.O.M.

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	WS 4T - .5	M12 90 degree connector and cable
2	1	38201 (waytek)	FEMALE METRI-PACK 150 2 pin
3	2	31077 (waytek)	FEMALE TERMINALS 16-18 AWG
4	2	38202 (waytek)	TPA LOCK
4	2	39006 (waytek)	CABLE SEALS



Notes:

- 18 AWG, 2 Conductor cable
- Label to be white w/ black printing and located on cable per drawing. (mylar w/ clear cover, all caps, 15pt font)
- M12 MATES TO SENSOR BOX 4MB12-4P2

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#TS-2017

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REV	DATE	DESCRIPTION
A	-	-
B	-	-
C	-	-
D	-	-
E	-	-

DESIGN: JTM	DRAWN: JTM	AS BUILT: -	PROJECT NUMBER: TS-2017	SCALE: NONE	DATE: 8-2-06	REV: -
			SHT 1 OF 1			

SPREADER CABLE SYSTEM

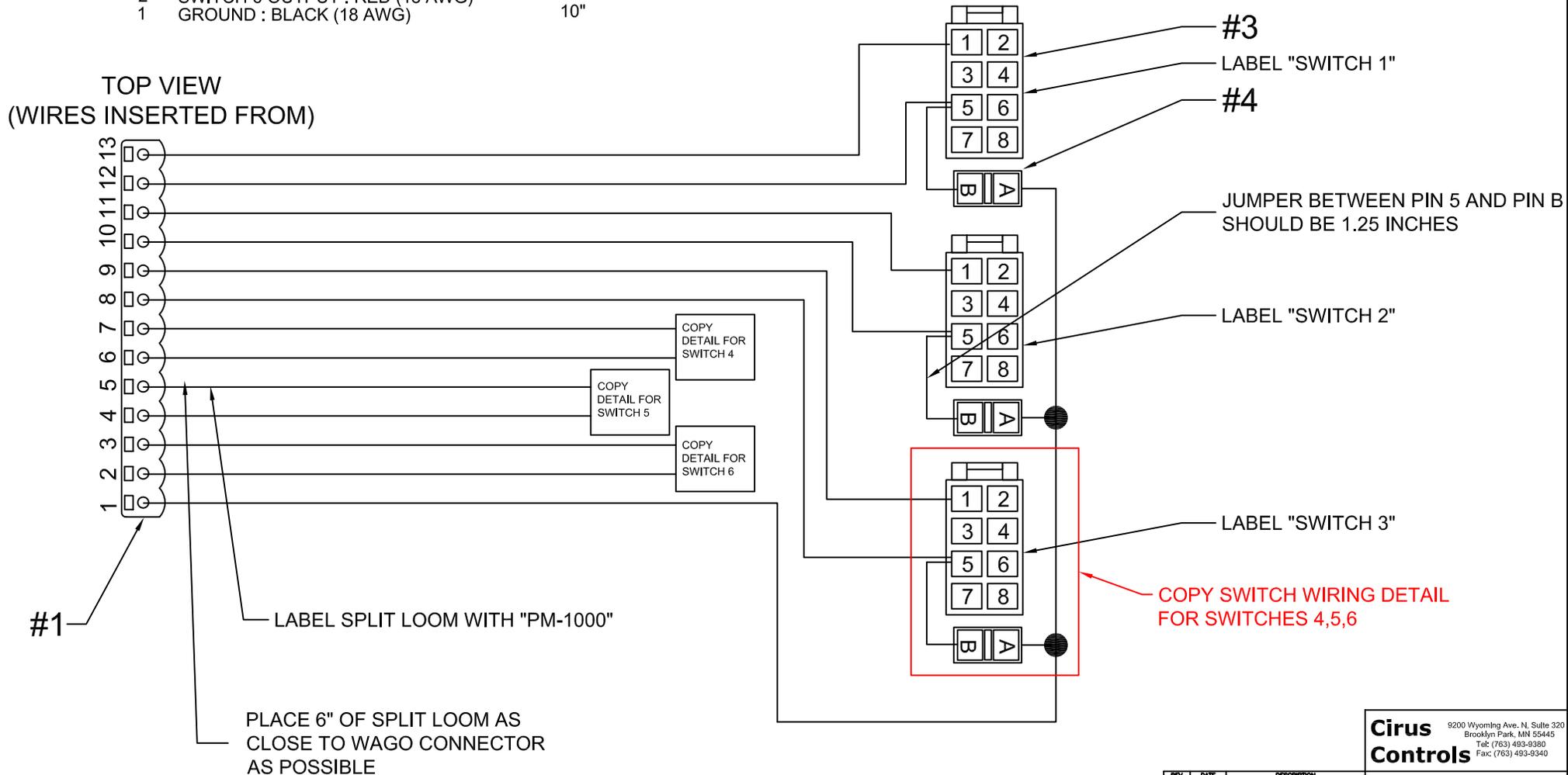
M12 TO METRI-PACK 150

PIN#	SIGNAL	LENGTH
13	SWITCH 1 POWER : ORANGE (18 AWG)	10"
12	SWITCH 1 OUTPUT : RED (18 AWG)	10"
11	SWITCH 2 POWER : GREEN (18 AWG)	10"
10	SWITCH 2 OUTPUT : RED (18 AWG)	10"
9	SWITCH 3 POWER : YELLOW (18 AWG)	10"
8	SWITCH 3 OUTPUT : RED (18 AWG)	10"
7	SWITCH 4 POWER : BLUE (18 AWG)	10"
6	SWITCH 4 OUTPUT : RED (18 AWG)	10"
5	SWITCH 5 POWER : WHITE (18 AWG)	10"
4	SWITCH 5 OUTPUT : RED (18 AWG)	10"
3	SWITCH 6 POWER : GREY (18 AWG)	10"
2	SWITCH 6 OUTPUT : RED (18 AWG)	10"
1	GROUND : BLACK (18 AWG)	10"

B.O.M.

#	QTY	PART NUMBER	DESCRIPTION
1	1	231-643 /019-000	13 PIN WAGO BULKHEAD RECEPTACLE
2	24	SPC-2004	FEMALE SPADES FOR SPRAGUE PLUGS
3	6	SP596.289	SPRAGUE PLUG FOR SWITCH
4	6	SP913.328	SPRAGUE PLUG FOR LIGHT
5	6 in	LCP-413	SPLIT LOOM

TOP VIEW (WIRES INSERTED FROM)



CABLE # PM-1000

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REV	DATE	DESCRIPTION
A	-	-
B	-	-
C	-	-
D	-	-
E	-	-

DESIGN: JTM	DRAWN: JTM	AS BUILT: -	PROJECT NUMBER: PM-1000	SCALE: NONE	DATE: 7-11-08	REV: -
			SHT 1 OF 1			

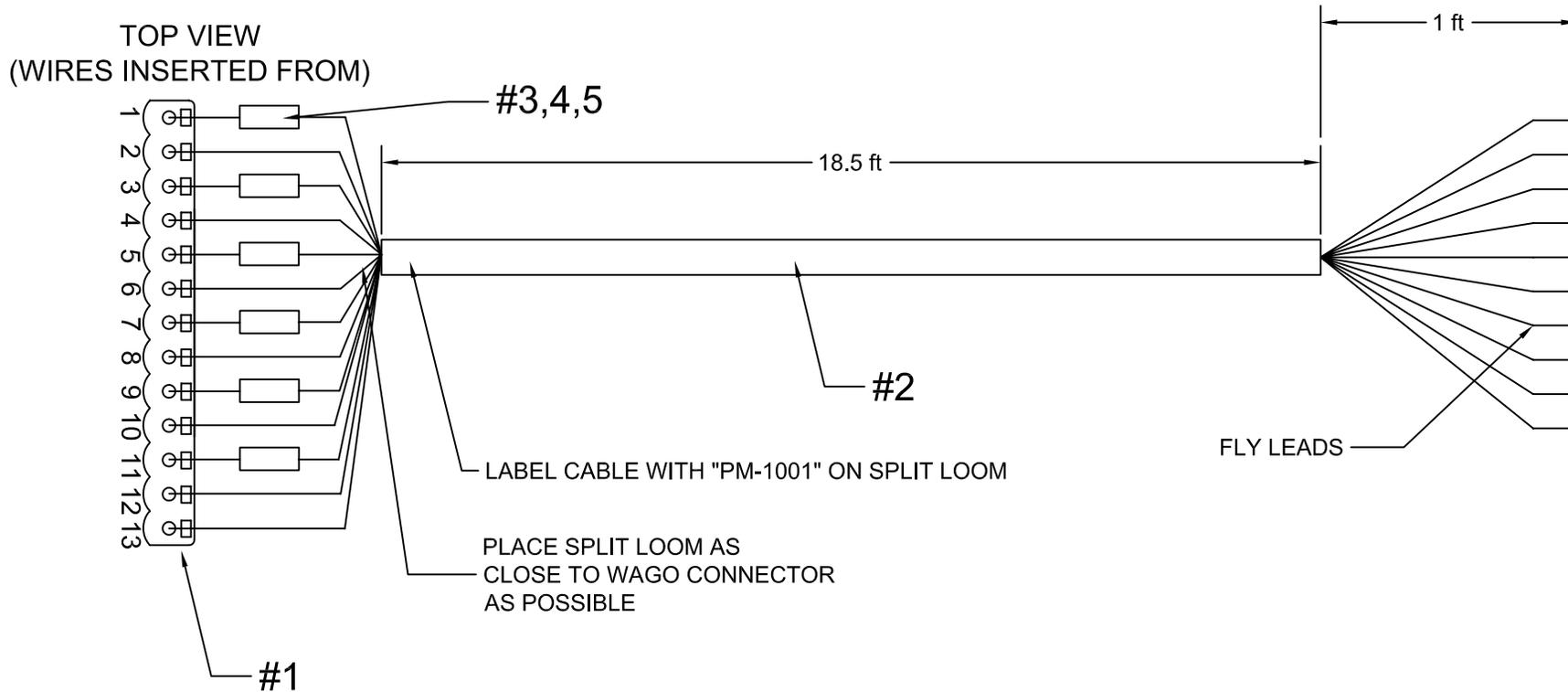
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Brooklyn Park, MN 55445
Tel: (763) 493-9380
Fax: (763) 493-9340

PEDESTAL MOUNT
SWITCH WIRING

PIN#	SIGNAL	LENGTH
1	SWITCH 1 POWER : ORANGE (18 AWG)	20 ft
2	SWITCH 1 OUTPUT : RED (18 AWG)	20 ft
3	SWITCH 2 POWER : GREEN (18 AWG)	20 ft
4	SWITCH 2 OUTPUT : RED (18 AWG)	20 ft
5	SWITCH 3 POWER : YELLOW (18 AWG)	20 ft
6	SWITCH 3 OUTPUT : RED (18 AWG)	20 ft
7	SWITCH 4 POWER : BLUE (18 AWG)	20 ft
8	SWITCH 4 OUTPUT : RED (18 AWG)	20 ft
9	SWITCH 5 POWER : WHITE(18 AWG)	20 ft
10	SWITCH 5 OUTPUT : RED (18 AWG)	20 ft
11	SWITCH 6 POWER : GREY (18 AWG)	20 ft
12	SWITCH 6 OUTPUT : RED (18 AWG)	20 ft
13	GROUND : BLACK (18 AWG)	20 ft

B.O.M.

#	QTY	PART NUMBER	DESCRIPTION
1	1	231-313 /037-000	13 PIN WAGO PLUG WITH LOCKING TABS
2	18.5 ft	LCP-413	SPLIT LOOM
3	6	WAYTEK 46025	10 AMP IN LINE FUSE HOLDER
4	6	WAYTEK 46026	10 AMP IN LINE FUSE HOLDER COVER
5	6	WAYTEK 46256	10 AMP FUSE



NOTES:

1. LABEL WIRE WITH SIGNAL NAME EVERY 12 INCHES

CABLE # PM-1001

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REV	DATE	DESCRIPTION
A	-	-
B	-	-
C	-	-
D	-	-
E	-	-

DESIGN: JTM	DRAWN: JTM	AS BUILT: -	PROJECT NUMBER: PM-1001	SCALE: NONE	DATE: 7-11-08	REV: -
			SHT 1 OF 1			

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PEDESTAL MOUNT

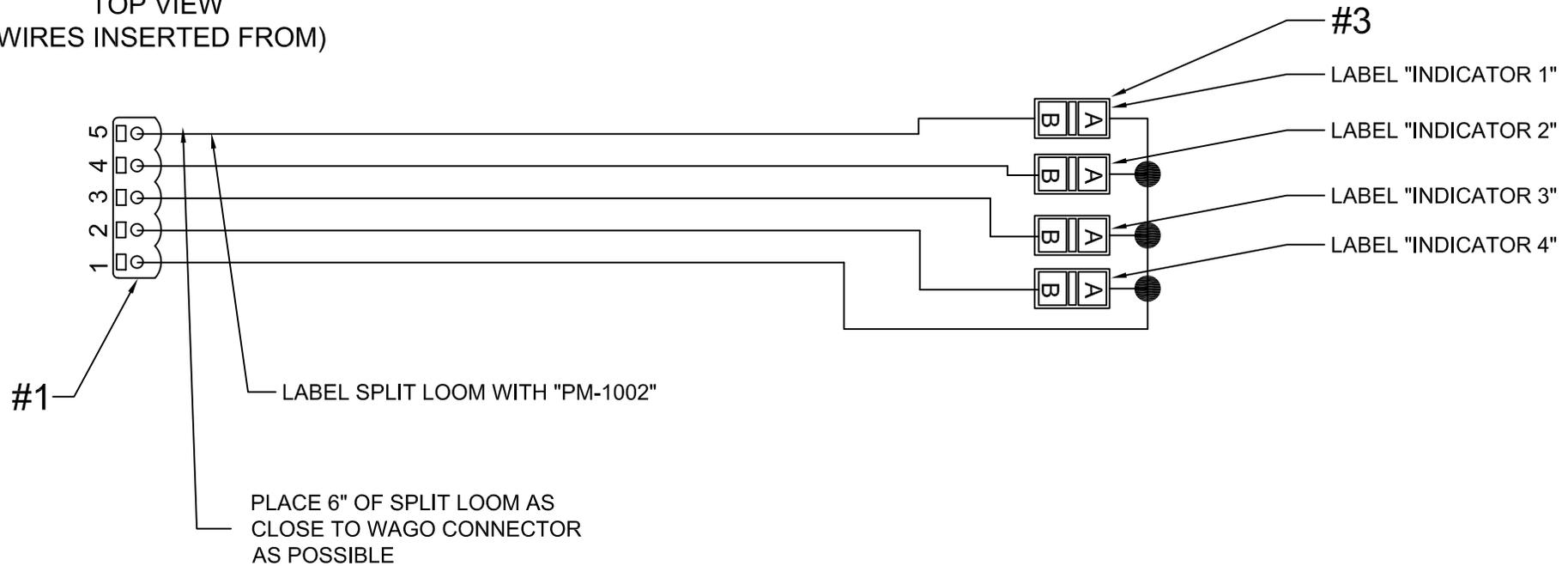
EXTERNAL SWITCH WIRING

PIN#	SIGNAL	LENGTH
5	INDICATOR 1 : BROWN (18 AWG)	10"
4	INDICATOR 2 : PINK (18 AWG)	10"
3	INDICATOR 3 : ORANGE (18 AWG)	10"
2	INDICATOR 4 : BLUE (18 AWG)	10"
1	GROUND OR POWER : RED (18 AWG)	10"

B.O.M.

#	QTY	PART NUMBER	DESCRIPTION
1	1	231-605 /019-000	5 PIN WAGO BULKHEAD RECEPTACLE
2	8	SPC-2004	FEMALE SPADES FOR SPRAGUE PLUGS
3	4	SP913.328	SPRAGUE PLUG FOR LIGHT
4	6 in	LCP-413	SPLIT LOOM

TOP VIEW
(WIRES INSERTED FROM)



CABLE # PM-1002

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REV	DATE	DESCRIPTION
A	-	-
B	-	-
C	-	-
D	-	-
E	-	-

DESIGN: JTM	DRAWN: JTM	AS BUILT: -	PROJECT NUMBER: PM-1002	SCALE: NONE	DATE: 7-11-08	REV: -
						SHT 1 OF 1

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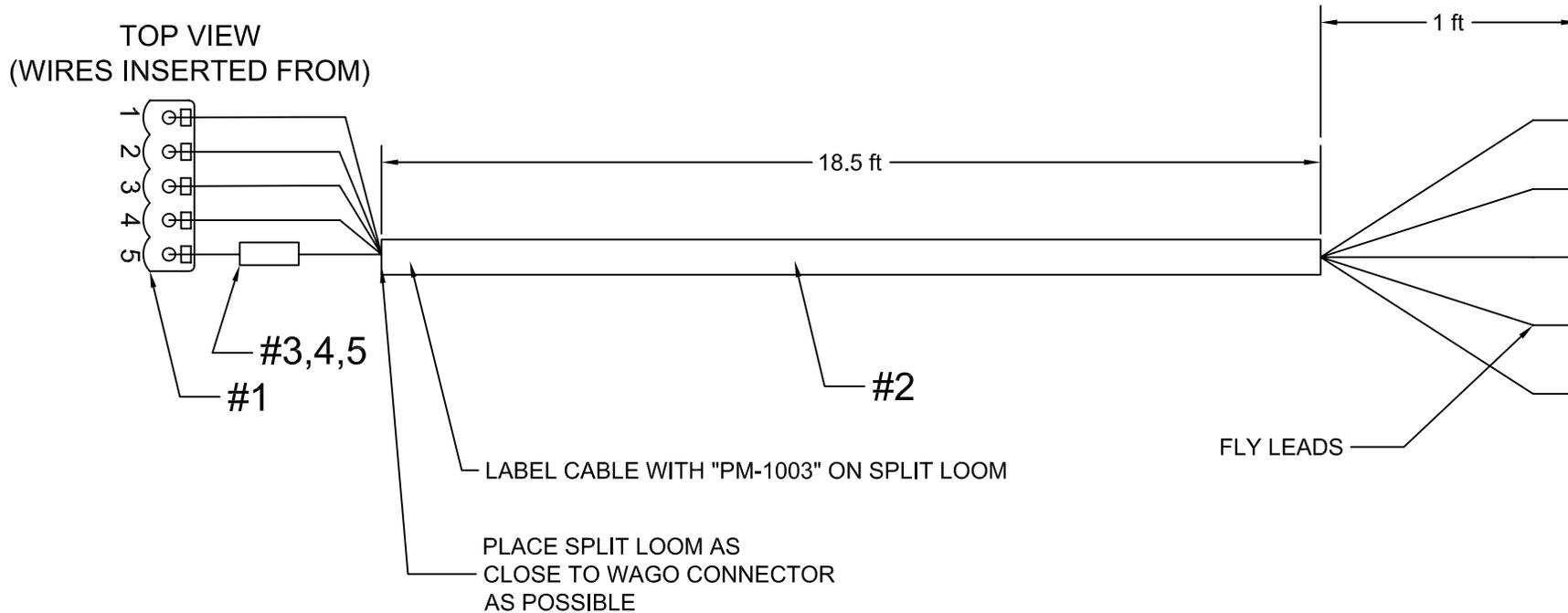
PEDESTAL MOUNT

INDICATOR WIRING

B.O.M.

PIN#	SIGNAL	LENGTH
1	INDICATOR 1 : BROWN (18 AWG)	20 ft
2	INDICATOR 2 : PINK (18 AWG)	20 ft
3	INDICATOR 3 : ORANGE (18 AWG)	20 ft
4	INDICATOR 4 : BLUE (18 AWG)	20 ft
5	GROUND OR POWER : RED (18 AWG)	20 ft

#	QTY	PART NUMBER	DESCRIPTION
1	1	231-305 /037-000	5 PIN WAGO PLUG WITH LOCKING TABS
2	18.5 ft	LCP-413	SPLIT LOOM
3	1	WAYTEK 46025	10 AMP IN LINE FUSE HOLDER
4	1	WAYTEK 46026	10 AMP IN LINE FUSE HOLDER COVER
5	1	WAYTEK 46256	10 AMP FUSE



NOTES:

1. LABEL WIRE WITH SIGNAL NAME EVERY 12 INCHES

CABLE # PM-1003

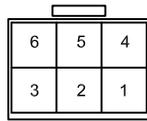
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REV	DATE	DESCRIPTION
A	-	-
B	-	-
C	-	-
D	-	-
E	-	-

DESIGN: JTM	DRAWN: JTM	AS BUILT: -	PROJECT NUMBER: PM-1003	SCALE: NONE	DATE: 7-11-08	REV: -
			EXTERNAL INDICATOR WIRING		SHT 1 OF 1	

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PEDESTAL MOUNT

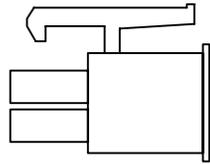


BACK VIEW
(SIDE PINS ARE INSERTED FROM)

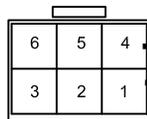
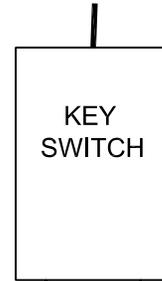
B.O.M.

#	QTY	PART NUMBER	DESCRIPTION
1	1	39-01-2060 OR WM3702-ND	6 PIN MOLEX PLUG WITH LOCK
2	2	39-00-0039 OR WM2501-ND	MOLEX SOCKETS FOR PLUGS
3	2	634	RING CONNECTOR
4	2	?	24 AWG WIRE

SENSOR ON CPU MOLEX PIN# SIGNAL



- 1 RETURN WIRE FROM KEY : GREEN 18" LONG
- 2 NOT USED
- 3 NOT USED
- 4 WIRE TO KEY : GREEN 18" LONG
- 5 NOT USED
- 6 NOT USED



BACK VIEW
(SIDE PINS ARE INSERTED FROM)



HOIST KEYSWITCH WIRING (FOR HOIST ON/OFF, LIMIT LOCKOUT & LIMIT OVERRIDE)

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REV	DATE	DESCRIPTION
A	4-24-07	Updated wiring for sensor input & output
B	-	-
C	-	-
D	-	-
E	-	-

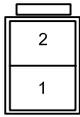
DESIGN: JTM	DRAWN: JTM	AS BUILT: -	PROJECT NUMBER: -	SCALE: NONE	DATE: 4-24-07	REV: A
						SHT 1 OF 1

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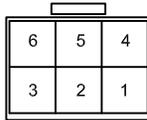
HOIST KEYSWITCH WIRIN-BLACK-TIP

INTERNAL WIRING

B.O.M.

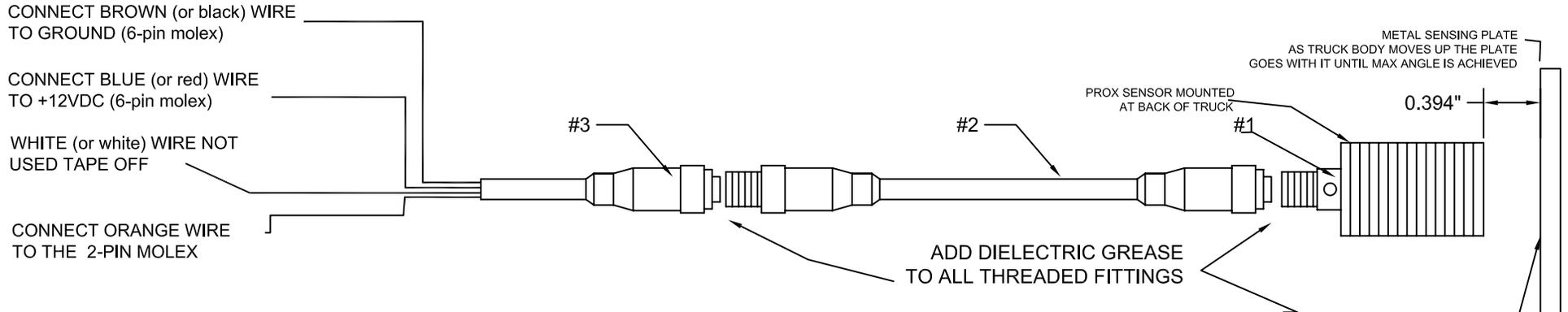


BACK VIEW
(SIDE PINS ARE INSERTED FROM)



BACK VIEW
(SIDE PINS ARE INSERTED FROM)

#	QTY	PART NUMBER	DESCRIPTION
1	1	Bi10-M30-VP4X-H1141	PROX SENSOR FOR MONITORING HOIST LIMIT
2	1	TS-2101	20FT CABLE FROM CAB TO SENSOR
3	1	TS-2100	10 FT IN CAB CABLE
4	1	595.2	2 PIN MOLEX PLUG WITH LOCK
5	1	39-01-2060 OR WM3702-ND	6 PIN MOLEX PLUG WITH LOCK
6	3	39-00-0039 OR WM2501-ND	MOLEX SOCKETS FOR PLUGS



SENSOR HAS A MAX SENSING RANGE OF .394 INCHES. IF PLATE IS FURTHER THEN THAT AWAY FROM THE SENSOR IT WILL NOT SEE IT.

SENSOR	MOLEX PIN#	SIGNAL
	1	NOT USED
	2	NOT USED
	3	NOT USED
	4	POWER (RED WIRE FROM TS-2100)
	5	NOT USED
	6	GND (BLACK WIRE FROM TS-2100)

AUGER REV OR HOIST LIMIT	MOLEX PIN#	SIGNAL
	1	NOT USED
	2	SIGNAL (ORANGE WIRE FROM TS-2100)

TYPICAL SETUP:
THIS CIRCUIT WILL ALLOW THE HOIST TO GO UP AND DOWN AS LONG AS THE SENSOR SIGNAL WIRE IS +12 VDC. AS SOON AS THE SIGNAL WIRE GOES TO GROUND THE HOIST WILL NO LONGER BE ABLE TO GO UP, BUT STILL WILL BE ABLE TO BE LOWERED.

IF A KEY SWITCH IS ADDED, AND THE SIGNAL LINE IS BROKEN (HOIST OVERRIDE DISABLED POSITION) THE HOIST WILL REMAIN ENABLED AT ALL TIMES

HOIST LIMIT SENSOR CIRCUIT

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REV	DATE	DESCRIPTION
A	4-28-07	ADDED OVERRIDE OF FORWARD PARTS
B	-	-
C	-	-
D	-	-
E	-	-

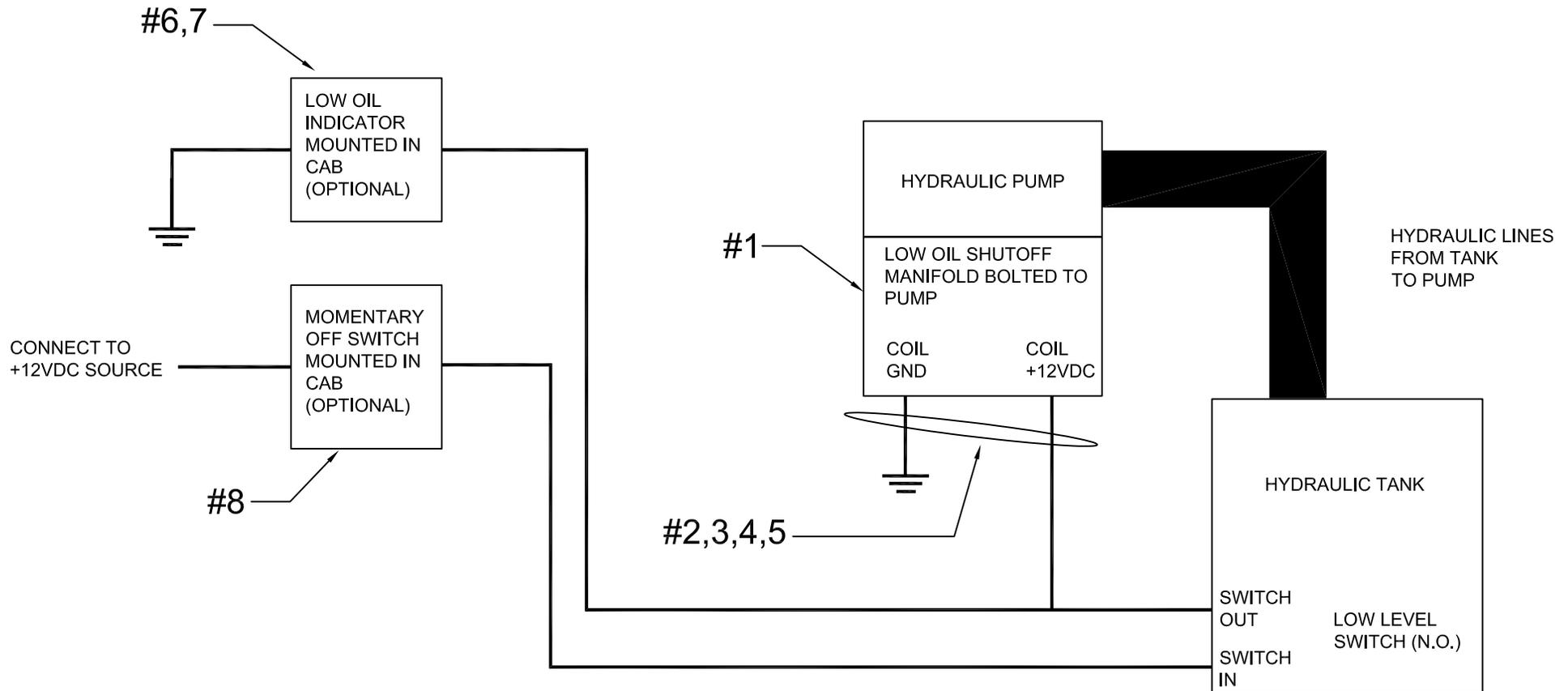
DESIGN: JTM	DRAWN: JTM	AS BUILT: -	PROJECT NUMBER: -	SCALE: NONE	DATE: 4-28-07	REV: A
			EXTERNAL WIRING		SHF 1 OF 1	

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Brooklyn Park, MN 55445
Tel: (763) 493-9380
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HOIST LIMIT OVERRIDE CIRCUIT-BLACK-TIP

B.O.M.

#	QTY	PART NUMBER	DESCRIPTION
1	1	HYD10001	LOW OIL SHUTOFF MANIFOLD WITH E-COIL METRI PACK CONNECTOR
2	1	625	2 POSITION FEMALE METRI-PACK 150 CONNECTOR ASSEMBLY
3	1	6251	TPA LOCKING PART FOR METRI-PACK 150
4	2	6252	FEMALE TERMINALS FOR METRI-PACK 150
5	2	6253	SEALS FOR METRI-PACK 150
6	1	1018	INDICATOR PANEL FOR LENS
7	1	1032	LOW OIL LENS
8	1	1020	MOMENTARY OFF SWITCH



THIS CIRCUIT WILL SHUT DOWN THE FLOW OF HYDRAULIC FLUID WHEN ITS LEVEL REACHES THE LOW SETTING IN THE TANK. WHEN THE LOW LEVEL IS REACHED A LIGHT WILL COME ON INDICATING LOW OIL, AND AT THE SAME TIME ENGAGE THE LOW OIL MANIFOLD TO PROTECT THE PUMP. A MOMENTARY OFF SWITCH CAN BE ADDED TO THE SYSTEM TO ALLOW THE DRIVER TO TEMPORARILY DISABLE THE PROTECTION TO MOVE AN IMPLEMENT.

LOW OIL SHUTDOWN WITH OVERRIDE

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REV	DATE	DESCRIPTION
A	-	-
B	-	-
C	-	-
D	-	-
E	-	-

DESIGN: JTM	DRAWING: JTM	AS BUILT: -	PROJECT NUMBER: LOW OIL	SCALE: NONE	DATE: 7-14-08	REV: -
			TRUCK WIRING			
			LOW OIL SHUTOFF WITH OVERRIDE OPTION			
			SHT 1 OF 1			