BI012589
JUNE 2013
VOLUME I of II

System Operation, Testing & Adjusting Manual

MD6640 Blast Hole Drill

Serial Number DR612159

Caterpillar Global Mining, LLC.
Electrical Adjustments For MD6640 Drill

	I 9.3	
	I 9.4	
	I 9.5	
	I 9.6	
	I 9.7	
	I 10 0	
	I 10.1	
	I 10 2	
	I 10 3	
	I 10.4	
	I 10 5	
	I 10 6	
	I 10.7	
	I 11 0	
	I 11.1	
	I 11 2	
	I 11 3	
	I 11.4	
	I 11 5	
	I 11 6	
	I 11.7	
SLOT 7		
	I 12 0	
	I 12.1	
	I 12 2	
	I 12 3	
	I 12.4	
	I 12 5	
	I 12 6	
	I 12.7	
	I 13 0	
	I 13.1	
	I 13 2	
	I 13 3	
	I 13.4	
	I 13 5	
	I 13 6	
	I 13.7	
	I 14 0	
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	I 14 2	
	I 14 3	
	I 14.4	
	I 14 5	
	I 14 6	
	I 14.7	
	I 15 0	
	I 15.1	
	I 15 2	
	I 15 3	
	I 15.4	
	I 15 5	
	I 15 6	
	I 15.7	
SLOT 8		
	I 16 0	
	I 16.1	
	I 16 2	
	I 16 3	
	I 16.4	
	I 16 5	
	I 16 6	
	I 16.7	
	I 17 0	
	I 17.1	
	I 17 2	
	I 17 3	
	I 17.4	
	I 17 5	
	I 17 6	
	I 17.7	
	I 18 0	
	I 18.1	
	I 18 2	
	I 18 3	
	I 18.4	
	I 18 5	
	I 18 6	
	I 18.7	
	I 19 0	
	I 19.1	

CATERPILLAR GLOBAL MINING, LLC.
ELECTRICAL ADJUSTMENTS FOR BLAST HOLE DRILLS
USING SIEMENS DC MOTION CONTROL DRIVES

ROTARY DRIVE START UP ADJUSTMENTS WITH POWER ON

PARAM. NO.	INDEX NO.	PARAM DESC.	DEFAULT VALUE	MDV810 ROTARY STD. VALUE	ACTUAL VALUE
P456	2	CONNECTOR SELECTOR SWITCH 1 CONTROL	0	20	
P457	1	INPUT FOR CONNECTOR SELECTOR SWITCH 2	0	230	
P458	1	CONNECTOR SELECTOR SWITCH 2 CONTROL	0	24	
P611	1	FIELD CURRENT REFERENCE SELECTION	277	231	
P664	1	SOURCE FOR CONTROL WORD 1, BIT 6	1	16	
P665	1	1ST SOURCE FOR CONTROL WORD 1, BIT 7	0	10	
P750	0	OUTPUT VALUE SOURCE, ANALOG OUTPUT 1	0	292	
P752	0	ANALOG OUTPUT 1 FILTER TIME	0	100	
P753	0	NORMALIZATION OF ANALOG OUTPUT 1	10	10.38	
P755	0	OUTPUT VALUE SOURCE, ANALOG OUTPUT 2	0	266	
P757	0	ANALOG OUTPUT 2 FILTER TIME	0	100	
P758	0	NORMALIZATION OF ANALOG OUTPUT 2	10	15	
P760	0	OUTPUT VALUE SOURCE, ANALOG OUTPUT 3	0	117	
P762	0	ANALOG OUTPUT 3 FILTER TIME	0	100	
P763	0	NORMALIZATION OF ANALOG OUTPUT 3	10	6.8	
P771	0	OUTPUT VALUE SOURCE, BINARY OUTPUT 1	0	107	
P820	7	DISABLE FAULT MONITORING	0	38	
P820	8	DISABLE FAULT MONITORING	0	42	
P820	9	DISABLE FAULT MONITORING	0	48	
P820	10	DISABLE FAULT MONITORING	0	40	
P825	1	FIELD FEEDBACK ANALOG OFFSET	19139	*	
P825	2	FIELD FEEDBACK ANALOG OFFSET	19139	*	
P825	3	FIELD FEEDBACK ANALOG OFFSET	19139	*	
P826	1	AC LINE ZERO CROSSING CORRECTION	0	**	
P826	2	AC LINE ZERO CROSSING CORRECTION	0	**	
P826	3	AC LINE ZERO CROSSING CORRECTION	0	**	
P826	4	AC LINE ZERO CROSSING CORRECTION	0	**	
P826	5	AC LINE ZERO CROSSING CORRECTION	0	**	
P826	6	AC LINE ZERO CROSSING CORRECTION	0	**	
U580	0	CONTROL WORD FOR COMMUATION MONITORING	7	4	
U962	99	FUNCTION BLOCK PROCESSING SEQUENCE	299	0	
U962	100	FUNCTION BLOCK PROCESSING SEQUENCE	300	299	

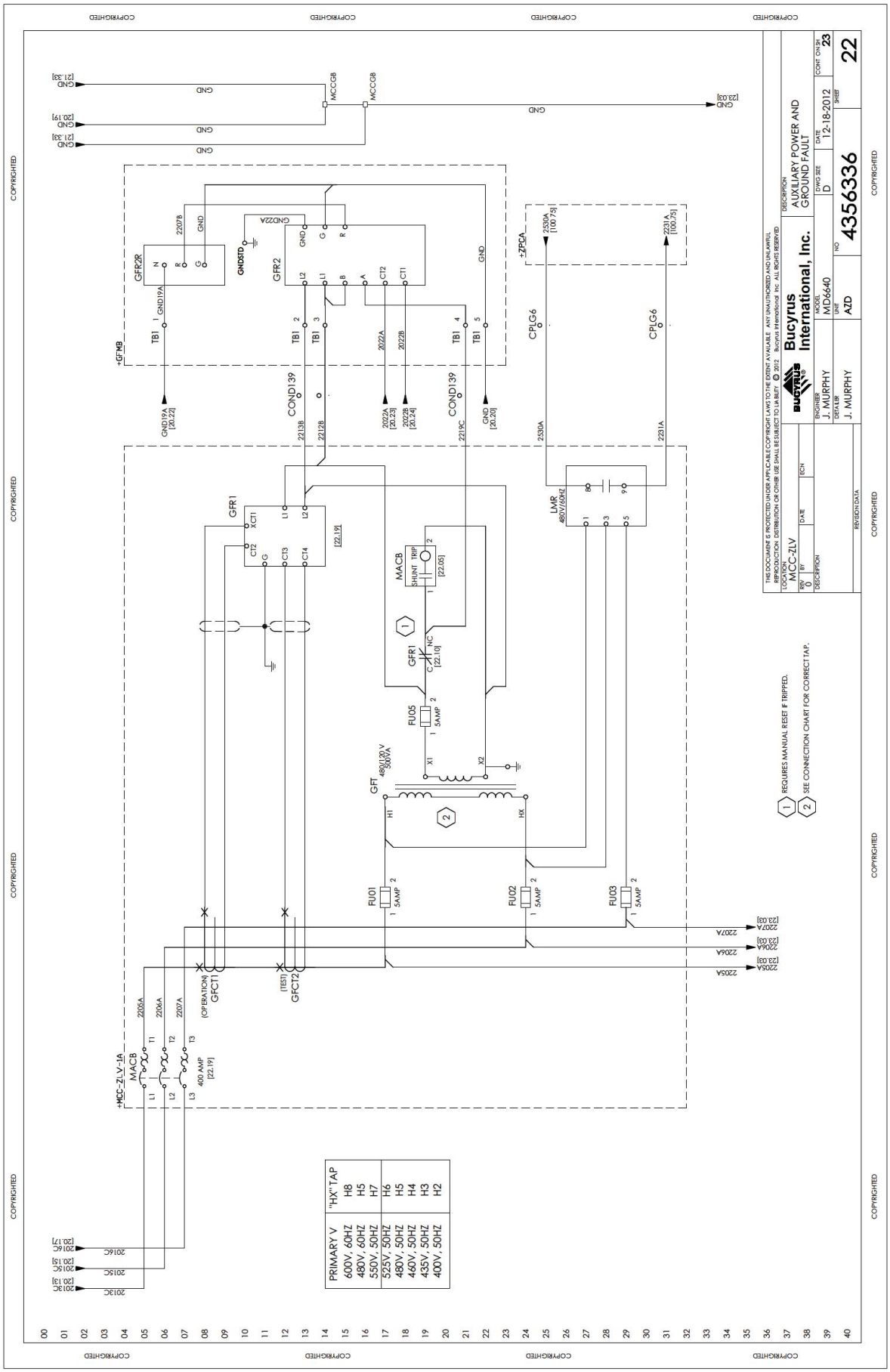
* AUTOMATICALLY DETERMINED BY THE DRIVE DURING THE PARAMETER DEFAULT PROCEDURE.

** AUTOMATICALLY DETERMINED BY THE DRIVE IF ARMATURE CURRENT CONTROLLER SELF TUNING IS PERFORMED.

SYMBOL DESCRIPTIONS

SYMBOL	DESCRIPTION	LOCATION	SHEET	LINE
ACAPT	AIR COMP. AIR PRESSURE TRANSDUCER	AC	110	19
ACATS	AIR COMPRESSOR AIR TEMP SENSOR	AC	110	37
ACATT	AIR COMPRESSOR AIR TEMP TRANSDUCER	ZPCA	110	36
ACC	AIR COMPRESSOR CONTACTOR	MCC-ZSC	21	19
ACCFM	AIR COMP. COOLER FAN MOTOR	ZZMF	23	62
ACCFMC	AIR COMP. COOLER FAN MOTOR CONTACTOR	MCC-ZLV-2A	200	70
ACCFMCB	AIR COMP. COOLER FAN MTR CKT BREAKER	MCC-ZLV-2A	23	62
ACCFMOL	AIR COMP. COOLER FAN OVERLOAD RELAY	MCC-ZLV-2A	23	62
ACD	AIR COMPRESSOR DISCONNECT	MCC-ZSC	21	04
ACDAVS	AIR COMPRESSOR DRILL AIR VALVE SOLENOID	ZZMF	201	45
ACIPS	AIR COMPRESSOR INLET PRESSURE SWITCH	AC	110	06
ACM	AIR COMPRESSOR MOTOR	AC	21	06
ACMH	AIR COMPRESSOR MOTOR HEATER	AC	811	34
ACMSR	AIR COMPRESSOR MOTOR START RELAY	ZPCA	200	74
ACO	AIR COMPRESSOR START CABINET OVERLOAD	MCC-ZSC	21	03
ACOFS1	AIR COMPRESSOR OIL FILTER SWITCH	AC	110	03
ACOPS	AIR COMPRESSOR OIL PRESSURE SWITCH	AC	110	11
ACOTS	AIR COMPRESSOR OIL TEMP SENSOR	AC	110	27
ACOTT	AIR COMPRESSOR OIL TEMP TRANSDUCER	ZPCA	110	26
ACSHM	AIR COMPRESOR START HYDRAULIC MOTOR	ZZMF	813	18
ACSHMC	AIR COMPRESSOR START HYDRAULIC MOTOR CONTACTOR	ZPCA	813	18
ACSHMO	AIR COMPRESSOR START HYDRAULIC MOTOR OVERLOAD	ZPCA	813	18
ACSTARTPB	AIR COMPRESSOR "START" PUSHBUTTON	ZPCA	100	32
ACSTOPPB	AIR COMPRESSOR "STOP" PUSHBUTTON	ZPCA	100	30
ACUSS	AIR COMPRESSOR UNLOAD SELECTOR SWITCH	ZCSL	500	46
ACVVS	AIR COMPRESSOR VENT VALVE SOLENOID	ZZMF	201	49
ACVVVS1	AIR COMP. VARIABLE VOLUME VALVE SOL.	AC	201	08
ACVVVS2	AIR COMP. VARIABLE VOLUME VALVE SOL.	AC	201	12
ACVVVS3	AIR COMP. VARIABLE VOLUME VALVE SOL.	AC	201	16
ANH	ANNUNCIATOR HORN	ZCCA	503	53
APK1	AUXILIARY POWER FUSED DISCONNECT	ZHVC	20	13
APK2	AUXILIARY POWER FUSED DISCONNECT	ZHVC	20	15
APK3	AUXILIARY POWER FUSED DISCONNECT	ZHVC	20	17
APT	AUXILIARY POWER TRANSFORMER	ZTH	20	15
ASCH1	AIR COMPRESSOR START CABINET HEATER	MCC-ZSC	810	06
BB5-4A	BREAKOUT BOARD A- NODE 5- MODULE 4	ZCSL	500	03
BB5-4B	BREAKOUT BOARD B- NODE 5- MODULE 4	ZCSL	500	44
BB5-5A	BREAKOUT BOARD A- NODE 5- MODULE 5	ZCSR	501	03
BB5-5B	BREAKOUT BOARD B- NODE 5- MODULE 5	ZCSR	501	44
BB5-6A	BREAKOUT BOARD A- NODE 5- MODULE 6	ZCCA	502	03
BB5-6B	BREAKOUT BOARD B- NODE 5- MODULE 6	ZCCA	502	44
BB5-8	BREAKOUT BOARD NODE 5 MODULE 8	ZCCA	503	44
BOWEVS	BREAK-OUT WRENCH EXTEND VALVE SOLENOID	ZZMA	304	24
BOWRVS	BREAK-OUT WRENCH RETRACT VALVE SOLENOID	ZZMA	304	20
BOWSS	BREAK-OUT WRENCH SELECTOR SWITCH	ZCSR	501	05
BSCSS	BOARDING STAIR CAB SELECTOR SWITCH	ZCCA	502	05

LOCATION					DESCRIPTION
REV 0	BY	DATE	ECN	Bucyrus International, Inc.	SYMBOL DESCRIPTIONS
DESCRIPTION				ENGINEER J. MURPHY	MODEL MD6640 / DWG SIZE D / DATE 12-18-2012 / CONT ON SH 9
REVISION DATA				DETAILER J. MURPHY	UNIT AZD / NO 4356336 / SHEET 8


Bucyrus International, Inc.
AUXILIARY POWER AND GROUND FAULT
4356336
22
MCC-2LV
MD6640
AZD
12-18-2012
J. MURPHY
J. MURPHY
REQUIRES MANUAL RESET IF TRIPPED.
SEE CONNECTION CHART FOR CORRECT TAP.
PRIMARY V | "HX" TAP
600V, 60HZ H8
480V, 60HZ H5
550V, 50HZ H7
525V, 50HZ H6
480V, 50HZ H5
460V, 50HZ H4
435V, 50HZ H3
400V, 50HZ H2

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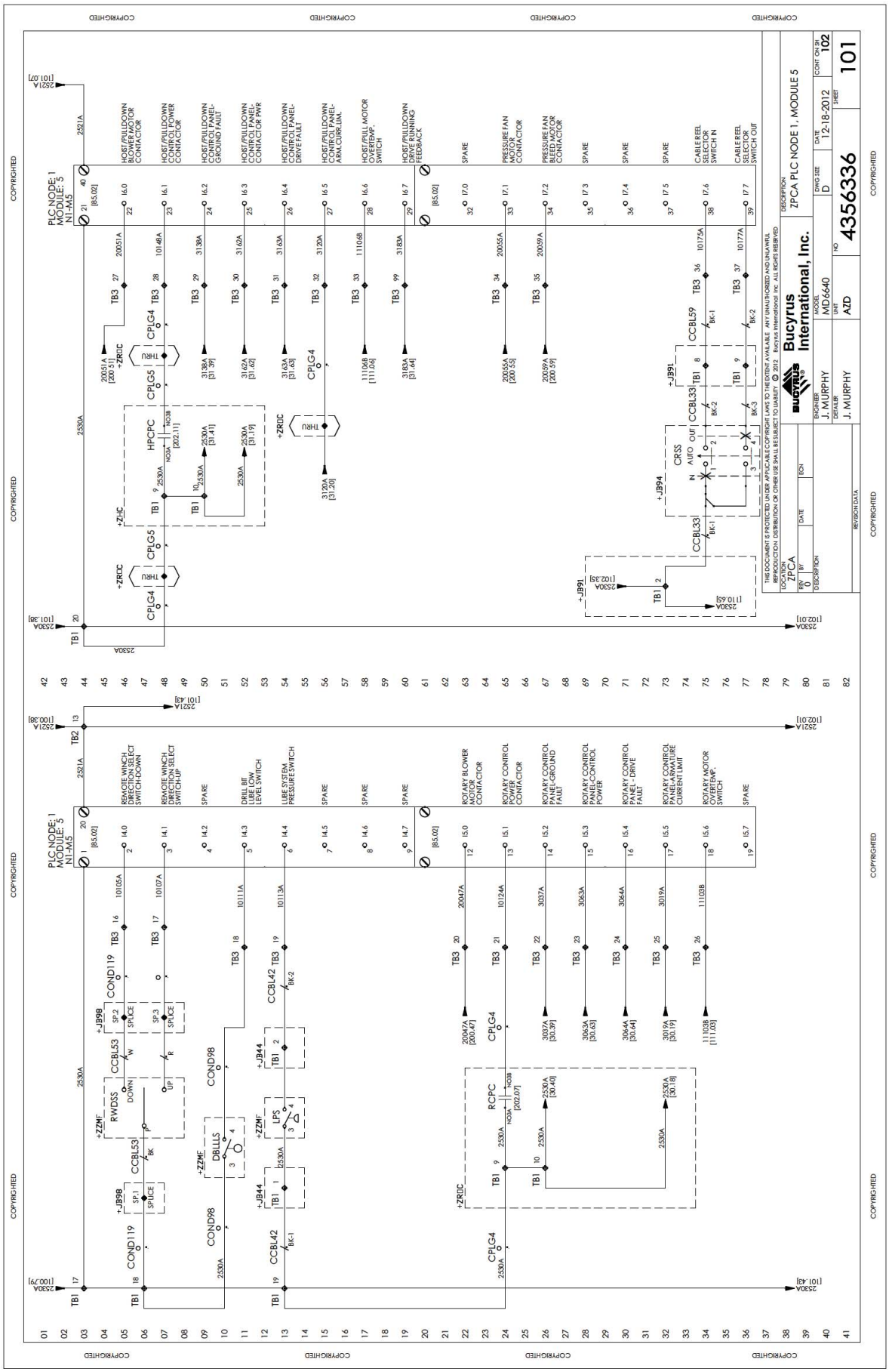
LOCATION	Bucyrus International, Inc.	DESCRIPTION	INTENTIONALLY BLANK
REV 0 / BY / DATE / ECN	ENGINEER J. MURPHY	MODEL MD6640	DWG SIZE D / DATE 12-18-2012 / CONT ON SH 35
DESCRIPTION	DETAILER J. MURPHY	UNIT AZD	NO 4356336 / SHEET 34
REVISION DATA			


PLC NODE 1 MODULE 5 N1-M5
PLC NODE 1 MODULE 3 N1-M5
HOIST/PULLDOWN BLOWER MOTOR CONTACTOR
HOIST/PULLDOWN CONTROL POWER CONTACTOR
HOIST/PULLDOWN CONTROL PANEL-GROUND FAULT
HOIST/PULLDOWN CONTROL PANEL-ARM CURR.LIM.
HOIST/PULLDOWN CONTROL PANEL-DRIVE FAULT
HOIST/PULL MOTOR OVERTEMP. SWITCH
HOIST/PULLDOWN DRIVE RUNNING FEEDBACK
SPARE
PRESSURE FAN MOTOR CONTACTOR
PRESSURE FAN BLEED MOTOR CONTACTOR
CABLE REEL SELECTOR SWITCH IN
CABLE REEL SELECTOR SWITCH OUT
REMOTE WINCH DIRECTION SELECT SWITCH-DOWN
REMOTE WINCH DIRECTION SELECT SWITCH-UP
DRILL BIT LUBE LOW LEVEL SWITCH
LUBE SYSTEM PRESSURE SWITCH
ROTARY BLOWER MOTOR CONTACTOR
ROTARY CONTROL POWER CONTACTOR
ROTARY CONTROL PANEL-GROUND FAULT
ROTARY CONTROL PANEL-CONTROL POWER
ROTARY CONTROL PANEL - DRIVE FAULT
ROTARY CONTROL PANEL-MAINTAIN CURRENT LIMIT
ROTARY MOTOR OVERTEMP. SWITCH
ZPCA PLC NODE 1, MODULE 5
Bucyrus International, Inc.
MODEL MD6640
UNIT AZD
NO 4356336
DATE 12-18-2012
SHEET 101
CONT ON SH 102
ENGINEER J. MURPHY
DRAFTER J. MURPHY
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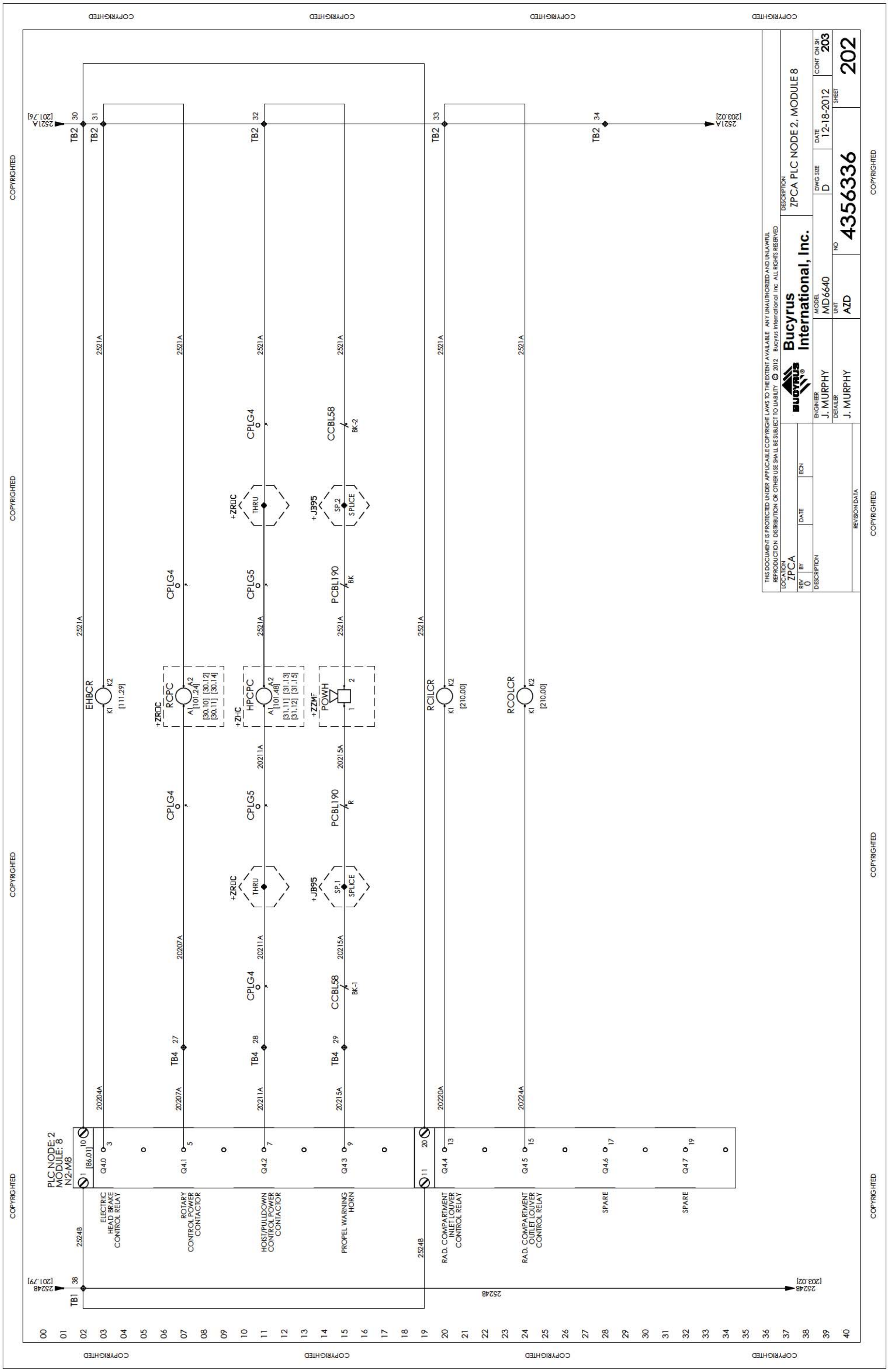
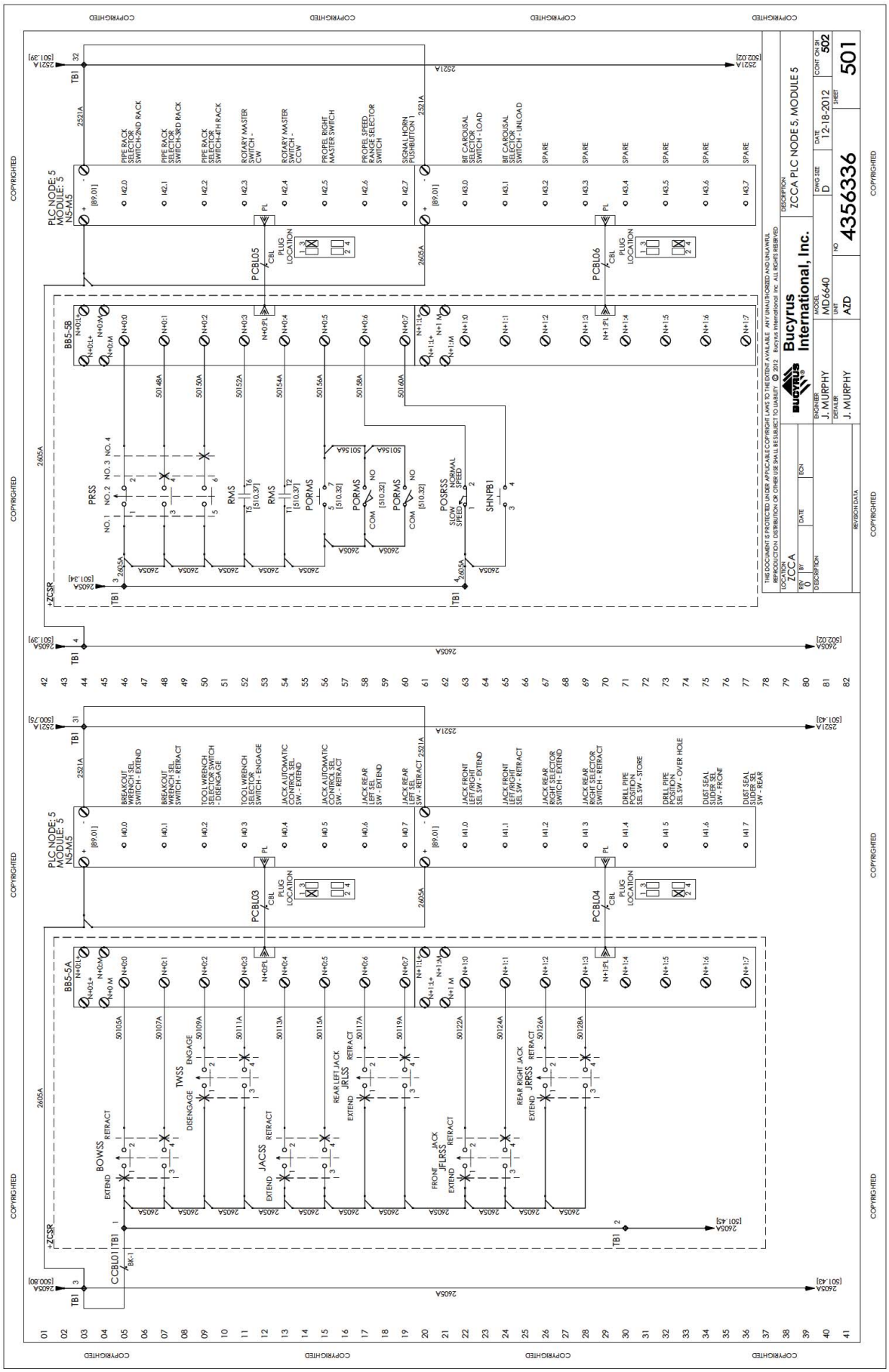

PLC NODE: 2
MODULE: 8
N2-M8
ELECTRIC HEAD BRAKE CONTROL RELAY
ROTARY CONTROL POWER CONTACTOR
HOIST/PULLDOWN CONTROL POWER CONTACTOR
PROPEL WARNING HORN
RAD. COMPARTMENT INLET LOUVER CONTROL RELAY
RAD. COMPARTMENT OUTLET LOUVER CONTROL RELAY
SPARE
SPARE
EHBCR
RCPC
HPCPC
POWH
RCILCR
RCOLCR
Bucyrus International, Inc.
ZPCA PLC NODE 2, MODULE 8
J. MURPHY
MD6640
AZD
D
12-18-2012
4356336
203
202


Bucyrus International, Inc.
ZCCA PLC NODE 5, MODULE 5
MODEL MD6640
UNIT AZD
NO 4356336
SHEET 501
DATE 12-18-2012
PLC NODE 5 MODULE 5 N5-M5
PCBL05
PCBL06
PCBL03
PCBL04
BB5-5B
BB5-5A
PRSS
RMS
PORMS
POSRSS
SHNPB1
BOWSS
JACSS
JFLRSS
JRLSS
JRRSS
TWSS
PIPE RACK SELECTOR SWITCH-2ND RACK
PIPE RACK SELECTOR SWITCH-3RD RACK
PIPE RACK SELECTOR SWITCH-4TH RACK
ROTARY MASTER SWITCH - CW
ROTARY MASTER SWITCH - CCW
PROPEL RIGHT MASTER SWITCH
PROPEL SPEED RANGE SELECTOR SWITCH
SIGNAL HORN PUSHBUTTON 1
BIT CAROUSAL SELECTOR SWITCH - LOAD
BIT CAROUSAL SELECTOR SWITCH - UNLOAD
SPARE
BREAKOUT WRENCH SEL SWITCH - EXTEND
BREAKOUT WRENCH SEL SWITCH - RETRACT
TOOL WRENCH SELECTOR SWITCH - DISENGAGE
TOOL WRENCH SELECTOR SWITCH - ENGAGE
JACK AUTOMATIC CONTROL SEL SW. - EXTEND
JACK AUTOMATIC CONTROL SEL SW. - RETRACT
JACK REAR LEFT SEL SW - EXTEND
JACK REAR LEFT SEL SW - RETRACT
JACK FRONT LEFT/RIGHT SEL SW - EXTEND
JACK FRONT LEFT/RIGHT SEL SW - RETRACT
JACK REAR RIGHT SELECTOR SWITCH - EXTEND
JACK REAR RIGHT SELECTOR SWITCH - RETRACT
DRILL PIPE POSITION SEL SW - STORE
DRILL PIPE POSITION SEL SW - OVER HOLE
DUST SEAL SLIDER SEL SW - FRONT
DUST SEAL SLIDER SEL SW - REAR
REAR LEFT JACK
REAR RIGHT JACK
FRONT JACK
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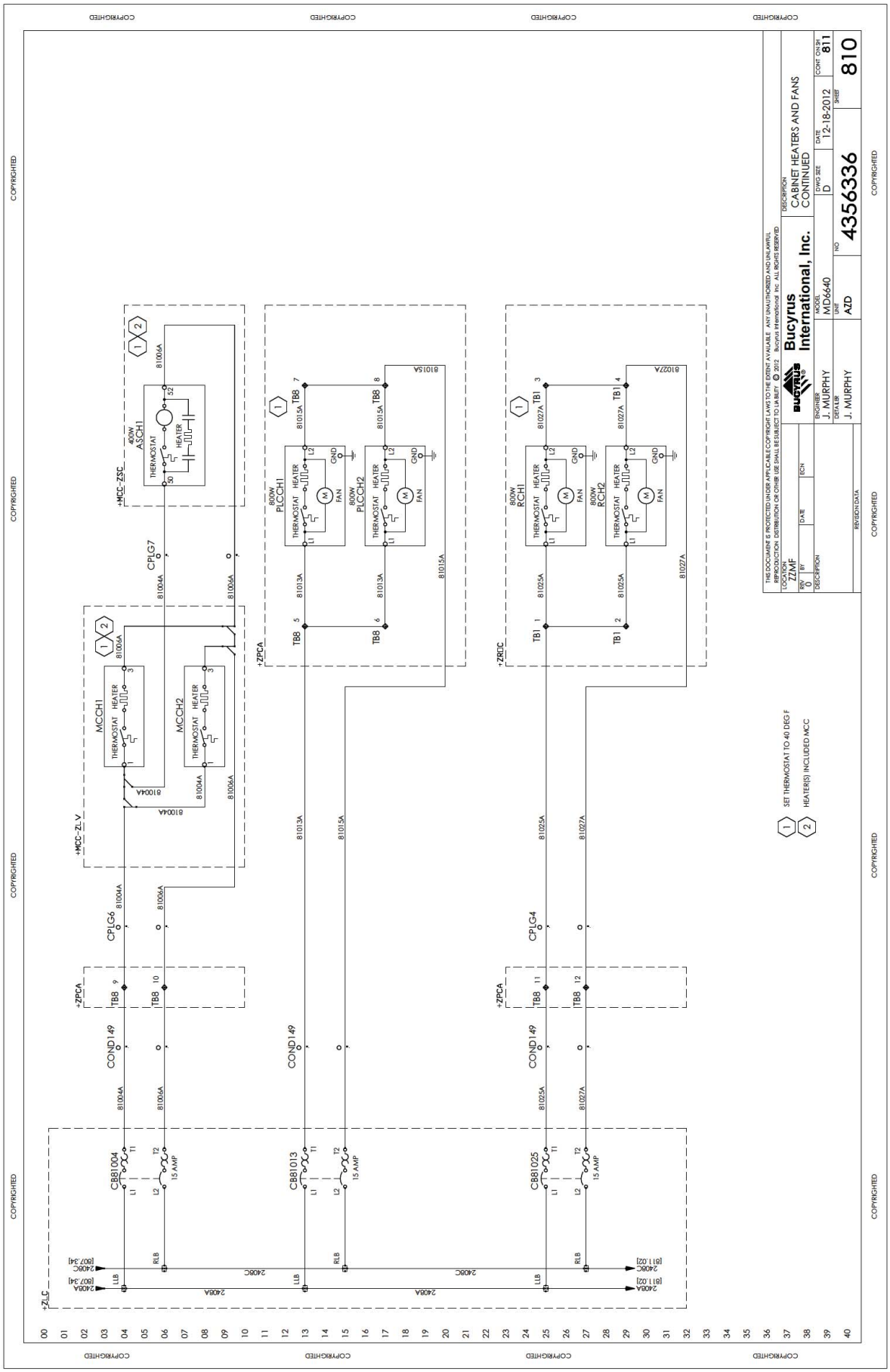
Bucyrus International, Inc.
CABINET HEATERS AND FANS CONTINUED
4356336
810
811
MD6640
AZD
J. MURPHY
12-18-2012
SET THERMOSTAT TO 40 DEG F
HEATER(S) INCLUDED MCC
+MCC-ZSC
+MCC-ZL-V
+ZPCA
+ZRDC
+ZLC
MCCH1
MCCH2
PLCCH1
PLCCH2
RCH1
RCH2
ASCH1
CPLG7
CPLG6
CPLG4
COND149
C881004
C881013
C881025
15 AMP
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TABLE OF CONTENTS

In the UP position, the hydraulic valve for raising the dust curtain is energized until the operator releases the selector switch. In the DOWN position, the hydraulic valve for lowering the dust curtain is energized until the operator releases the selector switch. An option can be set through the operator display to automatically raise the dust curtain when either PROPEL or REMOTE PROPEL modes are selected. In this case the hydraulic valve for raising the dust curtain is energized for 10 seconds upon entering these modes. See "Operator Display Instructions" for more information on this option.

Emergency Stop Maintained Pushbutton – ESPB1

This maintained pushbutton is located toward the rear of the left pod on the operator's chair. This button is wired in series with the other Emergency Stop buttons around the machine. Pressing any of these buttons has the same affect. As soon as this button is pressed, the control signal for the main air compressor motor is interrupted and it, along with the DC drives and all auxiliary equipment shuts down. Additionally, the power to all PLC outputs is interrupted, the control to the proportional hydraulic valves (hoist/pulldown, bit, propel, mast, etc.) is shut off, and an alarm is displayed on the operator display. Power to the PLC is not interrupted in order to maintain communication with the operator display. Since this is a maintained button, it is necessary to lift the button back up to allow normal operation to resume. The "Fault Reset" button on the operator display will also need to be pressed to clear the annunciation and allow operation.

> WARNING: This switch is for emergency use only. It is not to be used as a regular shutdown for the drill. Refer to the Operator's Manual for standard shutdown procedures.

Drill Pipe Position Selector Switch (STORE/OVER HOLE) – DPPSS (Option)

This momentary switch is used only on angle hole drilling capable machines and controls operation of the hydraulically actuated pipe positioner. It is functional whenever the hydraulic pump motor is ON (ACM running).

Dust Seal Slider Selector Switch (FRONT/REAR) - DSSSS (Option)

This momentary switch is used only on angle hole drilling capable machines and controls operation of the hydraulically actuated dust seal. It is functional whenever the hydraulic pump motor is ON (ACM running). Moving the switch to the REAR position will move the dust seal mechanism toward the rear of the machine, while moving the switch to the FRONT position will move the dust seal mechanism toward the front of the machine.

Propel Speed Range Selector Switch – POSRSS

This two-position selector switch is located in the right pod of the operator's chair. In the NORMAL position, full speed capabilities can be achieved. In the LOW position, top speed is limited to about 30% of maximum. Full resolution is allowed in the joysticks to allow fine positioning of the machine.

Horn Pushbutton – SHNPB1

This pushbutton is located in the right pod of the operator's chair. It is wired in series with the other horn buttons located throughout the drill. Pressing any of these buttons sounds the electric signal horn and is available any time control power is available.

Tool Wrench Selector Switch – TWSS

This three-position switch (with spring return to neutral) is used for controlling the tool wrench when adding or removing pipes from the drill string. It is located in the right pod of the operator's chair. The states of this switch are as follows:

Automatic Leveling

In addition to manual leveling switches, the 49HR incorporates logic for the automatic leveling of the drill. Pressing and holding the JACSS (Jack Automatic Control Selector Switch) in the EXTEND position will activate the automatic leveling logic as long as the button is held. The logic extends the leveling jacks until ground pressure is sensed in each jack before leveling the machine first in the side-to-side axis, and then in the front-to-rear axis. When the machine reaches "Fine Level", all jacks are extended simultaneously until the operator releases the Jack Automatic Control Selector Switch.

A customer selectable option is available through the Configuration Screen of the operator display to toggle One Touch Automatic Leveling. With this option enabled, the leveling process is carried out with one touch of the Jack Automatic Control Selector Switch rather than having to hold the switch down. The machine is automatically leveled and then all jacks are raised for 5 seconds after "Fine Level" has been achieved.

In both modes of automatic leveling, the machine must be within 7° of level before automatic functions can take place. If in a position where the drill has a tilt reading of greater than 7° the drill must be manually leveled to within this limit before pressing the Jack Automatic Control Selector Switch. An indicator on the Leveling Screen of the operator display will indicate when automatic leveling operations are allowed.

Retract Switches

The drill is also equipped with Jack Retract Switches. This will tell the operator, via the operator display if each of the jacks has been fully retracted. These switches are also integrated with the control logic to prevent certain operations, such as propel, if the jacks are down.

Mast

Operation

The raising and lowering of the mast is controlled with the same joystick used to control the right propel crawler track. This joystick is located in the right pod of the operator's chair. The mast can only be moved when the drill is in MAST/WINCH mode, as set by the DPMSS on the operator's chair.

In order for the mast to be raised or lowered with the joystick, the following conditions must be met.

NOTE: Other conditions may also be required due to customer requests or system enhancements.

- Control must be enabled (see above).
- The drill must be set in MAST mode.
- The head machinery must be lowered to the mast lower limit.

Mast Lock Pins

These hydraulically actuated pins are used to lock the mast in a vertical position and are controlled through buttons located on the Mast Operations Screen of the operator display. To function, the hydraulic pump motor must be on (ACM running) and the DPMSS (Drill/Propel/Mast Selector Switch) must be in the MAST/WINCH position. At this point, the mast lock pins can operate in the LOCK direction. To function in the UNLOCK direction the rotary head assembly must be at the lower limit point. On machines that incorporate the angle hole drilling option, the additional restriction of having the A-frame pins in place is included. When controlling these pins through the operator display, pressing the Lock or Unlock Button will move both pins in the appropriate direction for 10 seconds, or until limit switches within the mast lock pin cylinders indicate that the pins are fully in the desired position.

Hardware

Overview

This subsection gives a brief overview of each of the original major components in the control system. It should be noted that some of these may differ on a specific drill due to customer request, design enhancements, or options.

Standard "Nodes"

All PLC nodes on the 49HR use a standard DIN rail rack configuration. In this setup, there is no separate backplane device. Rather, all modules are simply mounted to a large DIN rail with a "U" type connector linking the backplane of each device together. Figure 11 shows this connector by itself. Figure 12 shows it attached to an I/O card with the right card removed from the rack.

Figure 11 – "U" Connector

Figure 12 – "U" Connector with Right Card Removed

To remove a card, first disconnect its wiring arm (in the case of I/O modules) or its communication and power connections. Then, loosen the screw on the bottom-rear of the module, which holds the card to the DIN rail. Note that the processor and certain other devices may have two such screws. Then, swing the module up to disconnect it from the "U" connector and lift the module off the DIN rail. To replace a module, simply reverse the process. Note that if you are adding a module to the end or replacing more than one module, it may be necessary to add or move one of the "U" connectors. They snap into slots on the back of each module, and are bidirectional so that installing them backwards is not possible.

WARNING: Never remove a card with power applied. Always remove power from the rack you are working on before disconnecting or adding a card. Failure to follow this warning may result in damage to the system or card.

b. The JACSS (Jack Automatic Control Selector Switch) must be in its center off position.

c. Put the DPMSS (Drill/Propel/Mast Selector Switch) in the DRILL position.

d. Each jack manual selector switch controls a jack extend valve and a jack retract valve. When the selector switch is moved out of its center off position, the JLVS (Jack Loader Valve Solenoid) and a jack extend or retract valve are simultaneously energized. When the selector switch is returned to its center off position, the JLVS will turn off immediately. The jack extend or retract valve that was energized will turn off two seconds later. Verify that the correct jack valves are energized when the joysticks are operated as shown in the table below.

Switch	Position	PLC Input	PLC Output	Valve
JRLSS	Extend	I40.6	Q12.5	JRLLVS
JRLSS	Retract	I40.7	Q12.4	JRLRVS
JFLRSS	Extend	I41.0	Q12.1	JFLLVS
JFLRSS	Retract	I41.1	Q12.0	JFLRVS
JFLRSS	Extend	I41.0	Q12.3	JFRLVS
JFLRSS	Retract	I41.1	Q12.2	JFRRVS
JRRSS	Extend	I41.2	Q12.7	JRRLVS
JRRSS	Retract	I41.3	Q12.6	JRRRVS

8. The lubrication system hydraulic valves can be electrically tested using the procedure that follows.

   a. Use the Maintenance Screen of the operator display to ensure that automatic lubrication is not enabled.

   b. Display the Lubrication Screen on the operator display, and note the setting for the low pressure fault time.

   c. Press the Manual Lube Pushbutton on the Maintenance Screen of the operator display. The LDVS (Lube Direction Valve Solenoid) connected to output Q2.5 should energize immediately. After a delay of approximately one second, the LEVS (Lube Enable Valve Solenoid) connected to output Q2.6 should energize. When the low pressure fault time is exceeded, the operator display should annunciate a low pressure fault alarm. The lube system fault indicator on the Status Screen of the operator display should come on, and all of the lube valves should turn off.

Proportional Hydraulic Valves Electrical Setup

This section covers the adjustment of the proportional hydraulic valve control cards EHPC1, and EHPC2. Further adjustments should not be required unless a card is replaced. The following procedure can be used to check card operation and to make card adjustments should this be necessary. Refer to the C-sheets and electrical schematics.

1. Open and lockout the ACD air compressor disconnect. This will prevent operation of the air compressor motor during any of the testing that follows.

Drill Leveling System

The leveling system was adjusted and tested at the factory. It will be functionally checked in this section to verify that field wiring and piping are correct. Do not make adjustments unless absolutely certain that they are necessary.

The level sensors are precision inclinometers mounted to detect tilt in the front-to-rear and side-to-side axes of the drill. The inclinometer analog signals are sent to the PLC which controls the jacks in the automatic leveling mode and scales the signals for the operator display.

1. Navigate to the Leveling/Propel Screen on the operator display. This provides complete information on the status of the leveling system. Indicators in the upper right corner of the display show when a jack is on the ground or fully retracted. Illuminated bars show the amount of front-to-rear and side-to-side tilt. In addition to the bar indication, the actual degrees of tilt are shown numerically at the bottom of the screen.

2. Put the DPMSS (Drill/Propel/Mast Selector Switch) in its DRILL position.

3. Make certain that all personnel are clear of the main air compressor. Put the ACUSS (Air Compressor Unload Selector Switch) in the CLOSE position, and start the compressor.

4. Make certain that all personnel and equipment are clear of the jacks.

5. Using the manual jack control switches, extend each jack until it touches the ground. The associated ground pressure indicator should illuminate on the operator display.

6. Using the manual jack control switches, fully retract each jack. The associated fully retracted indicator should illuminate on the operator display.

7. Manually level the drill with the jack control switches. Use the most accurate means available on site to determine when the drill is level. Surveying instruments or laser leveling devices can be used and provide good results. The level sensors will be checked using this manually obtained level condition as a reference.

8. The operator display side-to-side level and front-to-rear level numeric display values should be +/- 0.1 degrees or zero. If the values are greater than +/- 0.1 degrees, the level sensors can be adjusted using the procedure that follows.

    a. The inclinometers are located on the back panel of the ZCCA cabinet of the operator's cab. Both inclinometers are mounted as a single unit that sends two independent signals to the PLC.

    b. Open the cabinet and the cover of the inclinometer unit to check that there is incoming 24VDC to each of the inclinometer channels. 24VDC should be present on each of the channels opposite the signal wire to the PLC.

    c. Use the Test Analog Inputs Screen, or the PLC – Remote Rack 5 Screen to see the incoming signals from the clinometers. The screen will indicate 12.0mA if viewing voltage/current signal level, or 13824 if viewing PLC integer value, when the inclinometer channel is correctly zeroed.

    d. To adjust either inclinometer, turn the "Zero Pot" for the associated channel until the above values are achieved. Two potentiometers are provided for the adjustment of each channel. Channel 1 potentiometers (front-to-rear level indication) are located on the left

g. Return the master switch pot to neutral, and press the Control Enable Button to disable the drive.

35. The drive should now be checked under all operating conditions as follows:

    a. Run the drive in both directions for all drive speed switch positions.

    b. The motor speeds displayed on the operator display at maximum master switch pot travel should agree within +/- 5% of the C-sheet values.

36. This concludes the drive testing. Open the main power disconnect to the drive that was tested. Repeat the entire test procedure for the other drive if it has not been tested.

Head Encoder Checks and Replacement

Head position is sensed using an absolute encoder. The encoder signal is fed into the PLC where it is calibrated and converted to head position. The PLC compares head position to head limit values which are entered via the operator display. The hoist/pulldown drive reference is set to zero when head position reaches an upper or lower end of travel limit.

There is no need to ever mechanically set the encoder, since logic within the PLC can correctly display head position no matter where in its count range the encoder is received from the vendor. For initial calibration of the encoder or calibration of replacement encoder, see the Machine Calibration section of this document.

Water Injection System Start-Up

For start-up and calibration procedures regarding the optional water injection system refer to the appropriate X-Instruction listed on the machine C-Sheet.

Cable Reel System Start-Up

The optional cable reel is powered through the drill's hydraulic system. The cable reel will not function if the air compressor motor is not running due to the fact that the drill's hydraulic pumps are used to power it. If the air compressor motor is on, the cable will move if either the CRSS (Cable Reel Selector Switch), or the control buttons on the Leveling Screen of the operator display are moved to their IN or OUT positions.

In the auto mode of operation the cable reel will pick up cable off the ground whenever the drill is propelling forward. During forward steering or reverse propel, the reel will be in a free wheeling mode.

Proportional Hydraulic Card Setup (Option)

Depending on the design of the machine, the cable reel may use a proportional hydraulic card, located in the ZPCA (Programmable Controller Cabinet), to control the speed of the cable reel in and out movements. Depending on the PLC logic and control scheme used, this card may either provide a full analog range, or merely an on/off signal to the cable reel proportional valves. Regardless, setup of the hydraulic card (EHPC3) will be the same. This card is factory set and need only be adjusted if the EHPC3 card is replaced.

> WARNING: The air compressor/hydraulic pump motor must remain off during all of the following setup procedure, or unsafe operation of machine functions may

Fault	Message	Description / Effect	Recommended Action	Critical Fault
ANF048	Head Overspeed Fault	This fault occurs when the head exceeds the maximum speed (approximately 1.6 ft/s). Further use of the hoist functions are inhibited until the fault is reset.	1. Verify that the head is actually moving at a faulted speed. 2. If the speed is verified, refer to the hydraulic/mechanical documentation. 3. If the speed is NOT verified and the fault repeats, test and/or replace the head encoder.	
ANF049	Cable Reel Control Fault	This fault occurs when there is not feedback from the cable reel contactor.	1. Check the operation of the cable reel. 2. Verify the operation and/or wiring of the cable reel motor contactor. 3. On the operator display, check for feedback from the cable reel.	
ANF050	Radio Remote Tilt Shutdown	This fault occurs when the radio remote propel option is enabled and tilt becomes greater than 14 degree. This will disable radio remote control.	1. Check the level monitors to assure the tilt angle is greater than 14 degrees. 2. Propel the drill from the cab until tilt is less than 14 degrees.	
ANF051	Radio Remote Fault	If the radio remote option is installed and the operating mode switch is in the remote propel position for more than 5 seconds, outputs to power the receiver are turned on. After a delay to allow the receiver to power up, the inputs from both the receiver and transmitter must be present or this fault is set and control is disabled. Note: If the transmitter gets too far out of range, the transmitter on signal will be lost and control will be disabled.	1. Assure the remote transmitter is within the signal range. 2. Check the operations and/or wiring of the transmitter and receiver.	
ANF052	24VDC Control Power Fault	This fault occurs if 24VDC control power supply is not available. The emergency shutdown sequence will occur.	1. Check the connection and/or operation of the 24VDC control power supply.	X
ANF053	24VDC Input Power Fault	This fault occurs if the input power (24V) is not available to the PLC Node 1. The emergency shutdown sequence will occur.	1. Check the operation and/or connection of the 24VDC power supply to PLC Node 1.	X

APPENDIX B – PLC LED DIAGNOSTICS

Processor LED's

Figure 2 – Processor Status LED's

This table shows the status of the LED's on the PLC processor, located in the Console in the Operator's Cab. The description column shows some suggested procedures that might be able to fix the problem.

LED						
SF	**BF**	**DC5V**	**FRCE**	**RUN**	**STOP**	**Description**
OFF	OFF	**OFF**	OFF	OFF	OFF	Processor power is missing. Check power connections and breakers that feed the processor in the operator cab.
OFF	OFF	ON	OFF	ON	OFF	Normal operation.
OFF	X	ON	X	OFF	ON	CPU is on STOP mode. Move keyswitch on processor to RUN mode.
ON	OFF	ON	X	X	X	Processor or remote I/O node has an error. Possible solutions are: 1. Check remote nodes (including the operator cab display and the head encoder) to make sure a non-critical node fault is not causing this situation. 2. Move keyswitch on processor from STOP to RUN. 3. Cycle keyswitch on processor from RUN to STOP and then back to RUN. 4. Cycle power to the processor. 5. Reset the memory using the procedure outlined in the PLC section of this manual. 6. If the error was not found to be in the remote I/O or in the main rack's I/O modules, record what was happening when the error occurred.
X	OFF	ON	X	OFF	Flash 0.5Hz	Processor requires a memory reset. Possible solutions are: 1. Cycle power to the processor. 2. Reset the memory using the procedure outlined in the PLC section of this manual
X	X	ON	X	OFF	Flash 2Hz	Processor is executing a memory reset. This is information only and does not constitute a problem.

Decimal	Hexadecimal	Description
32835	8043	RAM error
32836	8044	ADC/DAC error
32837	8045	Fuse blown
32838	8046	Hardware interrupt lost
32839	8047	Reserved
32848	8050	Configuration/parameter assignment error
32849	8051	Common mode error
32850	8052	Short circuit to phase
32851	8053	Short circuit to ground
32852	8054	Wire break
32853	8055	Reference channel error
32854	8056	Below measuring range
32855	8057	Above measuring range
32864	8060	Configuration/parameter assignment error
32865	8061	Common mode error
32866	8062	Short circuit to phase
32867	8063	Short circuit to ground
32868	8064	Wire break
32869	8065	Reserved
32870	8066	No load voltage
32880	8070	Configuration/parameter assignment error
32881	8071	Chassis ground fault
32882	8072	Short circuit to phase (sensor)
32883	8073	Short circuit to ground (sensor)
32884	8074	Wire break
32885	8075	No sensor power supply
32896	8080	Configuration/parameter assignment error
32897	8081	Chassis ground fault
32898	8082	Short circuit to phase
32899	8083	Short circuit to ground
32900	8084	Wire break
32901	8085	Fuse tripped
32902	8086	No load voltage
32903	8087	Excess temperature
32944	80B0	Counter module, signal A faulty
32945	80B1	Counter module, signal B faulty
32946	80B2	Counter module, signal N faulty
32947	80B3	Counter module, incorrect value passed between the channels
32948	80B4	Counter module, 5.2 V sensor supply faulty
32949	80B5	Counter module, 24 V sensor supply faulty
33024	8100	Module fault/OK
33025	8101	Internal error
33026	8102	External error
33027	8103	Channel error
33028	8104	No external auxiliary voltage
33029	8105	No front connector
33030	8106	No parameter assignment
33031	8107	Incorrect parameters in module
33072	8130	User submodule incorrect/not found
33073	8131	Communication problem

APPENDIX D – PROFIBUS NODE DIAGNOSTICS

These tables list possible state and node information. These values are generally displayed on the PLC Diagnostics screen on the operator display (Main Menu – PLC/Profibus – PLC Status). The descriptions in this table were taken directly from the documentation supplied by the PLC manufacturer.
Note that not all codes are available on all devices

Node State

0 Node is OK
1 Node has failed
2 Node is faulty
3 Node is not configured properly and cannot be diagnosed

Error Type

1 Slot diagnosis (general specification of the faulty slot)
2 Module status (refinement of the slot diagnosis to include status of the module)
3 Channel diagnosis (location of the module, channel, and error type)
4 S7 diagnosis (Siemens PLC object)
5 Unit diagnosis
6 Slave diagnosis

Module State

This is only meaningful if the Error Type above is Type 2.

0 Module OK
1 Module fault
2 Incorrect module
3 No module

Channel Type

01 Input
02 Output
03 Input/Output
85 DP Interface Module

112 Digital Input
113 Analog Output
114 Digital Output
115 Analog Output
123 DP-Norm Channel (Input)
124 DP-Norm Channel (Output)
125 DP-Norm Channel (Other)

Channel Error

Code	Description
1	Short circuit on encoder or output line
2	Undervoltage – Supply
3	Overvoltage – Supply
4	Overload
5	Overtemperature
6	Wire Break
7	Upper Limit Violated
8	Lower Limit Violated

number, the parameter index, or the parameter value depending upon the selection made by the select key. Pressing the program key when either the raise or lower key is pressed will increase the change rate of the parameter number, parameter index number, or parameter value by a factor of ten. The change rate can be increased to 100 by pressing the lower key after the raise key has been pressed or by pressing the raise key after the lower key has been pressed. The size of the change increment is dependent upon the parameter that has been selected. The raise and lower keys are also used to start and stop drive self-tuning test functions.

The five digit display shows drive status codes during normal operation and diagnostic codes when faults occur. The select key can be used to reset the drive after a fault occurs. Indexed parameter r047 can be used to provide additional troubleshooting information on certain types of faults. Indexed parameter r947 can be used to display the numbers of the last eight faults that have occurred. Refer to the Simoreg 6RA70 Instruction manual for a complete listing of all status and fault codes.

Setting key parameter P051 to 40 provides the greatest access to drive parameters and allows all parameter values to be changed. This parameter defaults to 0 for no change access whenever drive power is cycled off and on. This prevents accidental or unauthorized change of the drive parameters. Parameter P051 is also used to set up drive self-tuning tests. Refer to the Simoreg 6RA70 Instruction manual for more detailed information on the use of the function keys and display. This manual also provides detailed information on each parameter, which includes the default value, value range, value adjustment increment, and P051 access code.

The Simoreg drive analog and binary input/output is used for the PLC interface. The drive analog interface signals are as follows:

a) The operator console speed reference pot is supplied with +/- 10 VDC from drive terminals CUD1/X174 - 1, 2, and 3. The reference pot wiper voltage is processed by the PLC, which feeds the resulting reference signal into drive analog input terminals CUD1/X174 - 4 and 5.

b) Hoist/pulldown drive analog input terminals CUD1/X174 - 6 and 7 are used for the programmed drill control current limit signal from the PLC.

c) Drive analog output terminal CUD1/X175 - 14 is the armature voltage signal to the PLC.

d) Drive analog output terminal CUD1/X175 - 16 is the field current signal to the PLC.

e) Drive analog output terminal CUD2/X164 - 18 is the armature current signal to the PLC.

aa) If the drive under test is hoist/pulldown, put the HBS brake switch in its release position. The head brake should release, and the drive should hold the head. If the head begins to accelerate downward, press the drive control off pushbutton immediately. If the hoist/pulldown drive has control of the head, set the master switch pot at 20% travel for hoist operation if the position of the drill head will allow hoist direction travel.

bb) If the drive under test is rotary, set the master switch pot at 20% travel for clockwise bit rotation.

b) If the motion runs in the wrong direction, press drive control off and open the drive disconnect. Reverse the motor field connections to the panel. Repeat the rotation check and verify that the direction of rotation is now correct.

c) Return the master switch pot to neutral and press the drive control off pushbutton.

d) If the drive under test was hoist/pulldown, put the HBS brake switch in its set position.

31) If the hoist/pulldown drive is being tested, the EHBC electric head brake control should be checked as follows.

a) Connect a DC voltmeter across wires CP169 and CP170 to the electric head brake operating coil. These wires are available on terminals 8 and 9 of the EHBC control located on the machinery house inside front wall. Wire CP169 will be positive, and the maximum expected voltage will be less than 300 volts DC.

b) If the hoist/pulldown drive successfully held the head in step 32aa above, ask the operator to press the drive control on pushbutton and put the HBS brake release switch in the release position.

c) The brake coil voltage measured from CP169 to CP170 should initially be about 239 VDC, and the red lamp on the EHBC cabinet door should be on. After approximately five seconds the red lamp should go out, and the coil voltage should decrease to about 72 VDC.

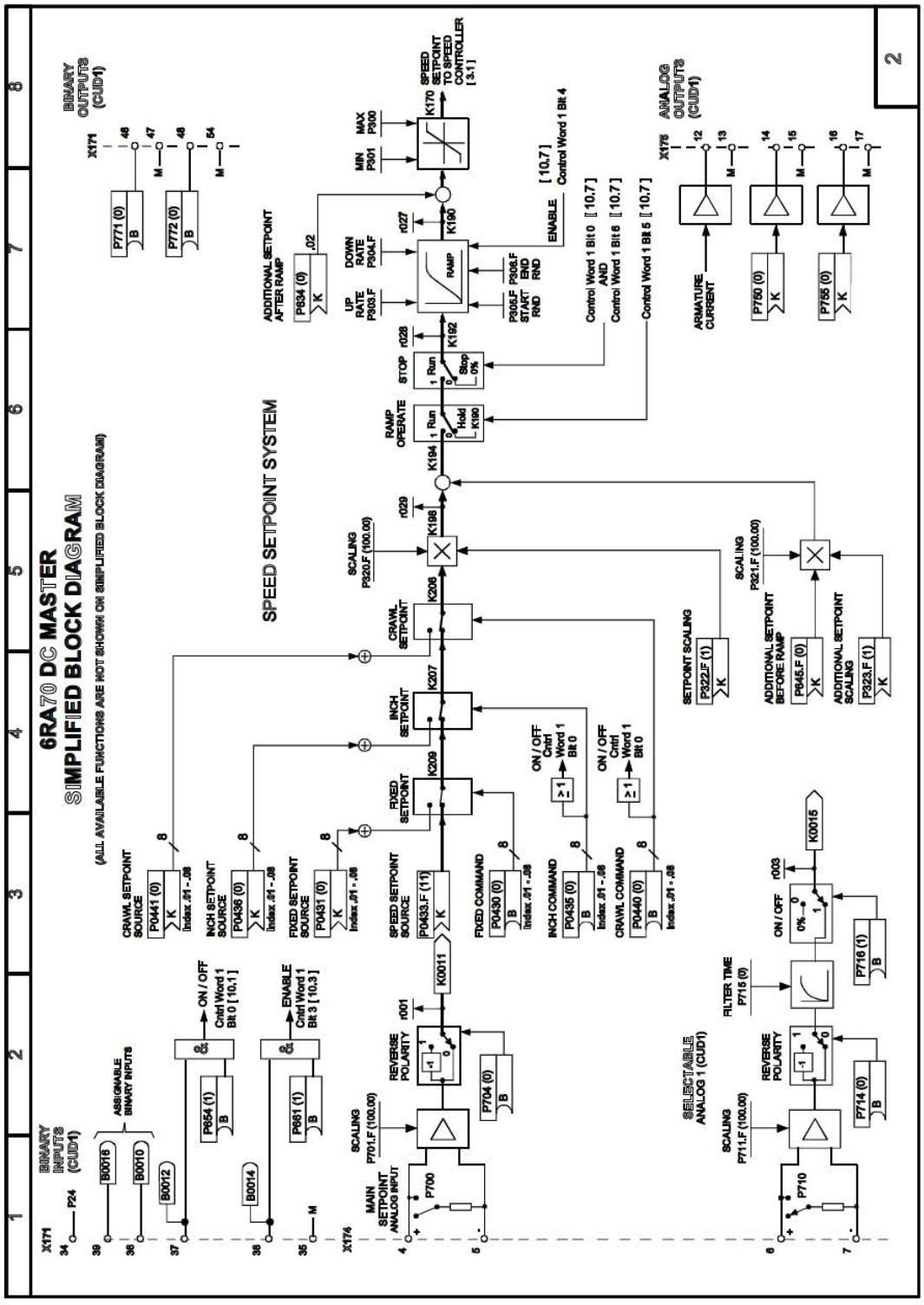
d) Put the HBS brake switch in the set position, and press the drive control off pushbutton.

32) The drive no load tests should be performed as follows:

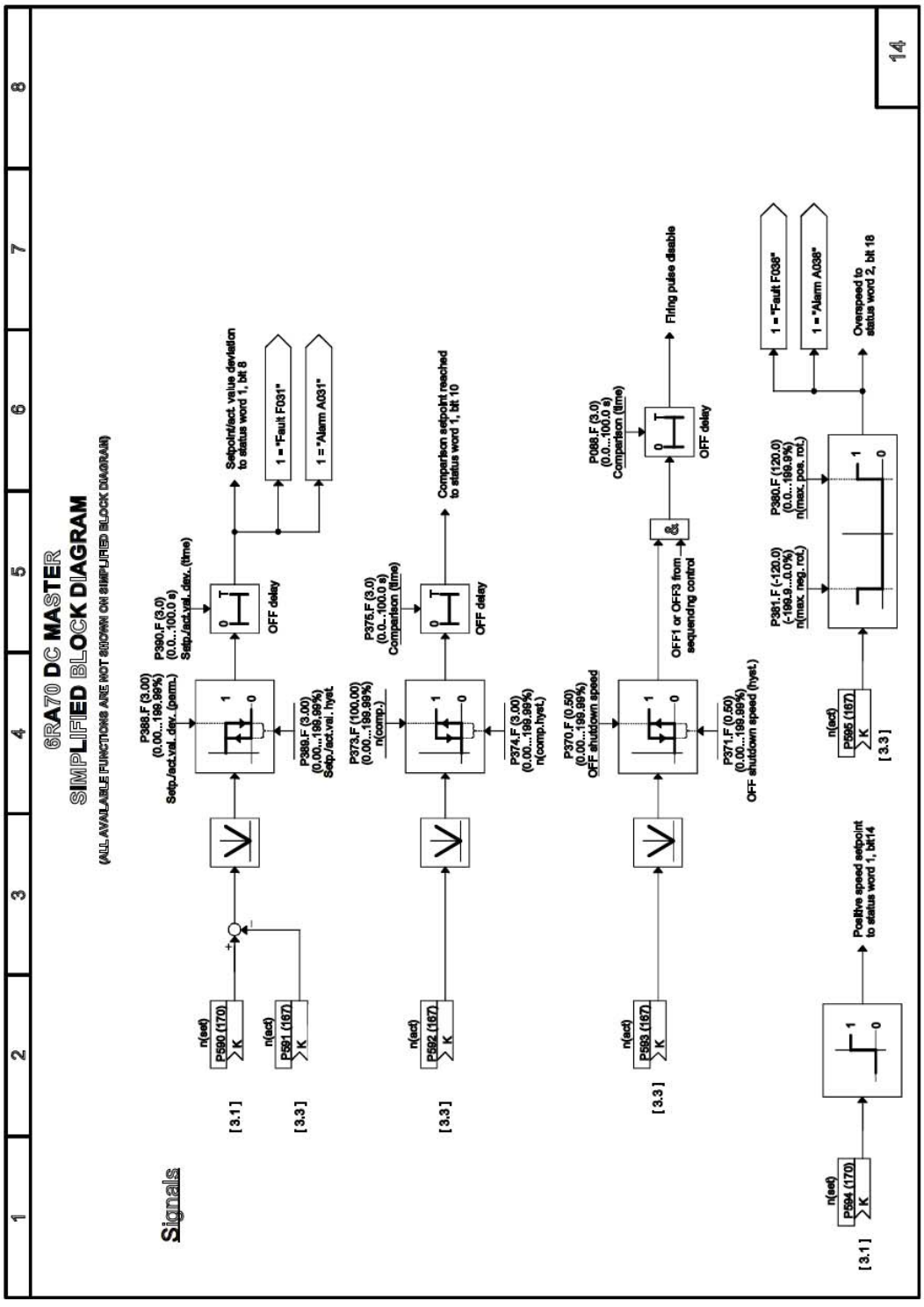
a) Install a DC voltmeter across drive armature output terminals A1 and A2. This is a +/- 500 VDC circuit (480 volts nominal).

b) Ask the operator to press the drive control on pushbutton. If the drive under test is hoist/pulldown, put the HBS brake switch in its release position and set the master

Sheet 2 Speed Setpoint System



Sheet 14 Signals



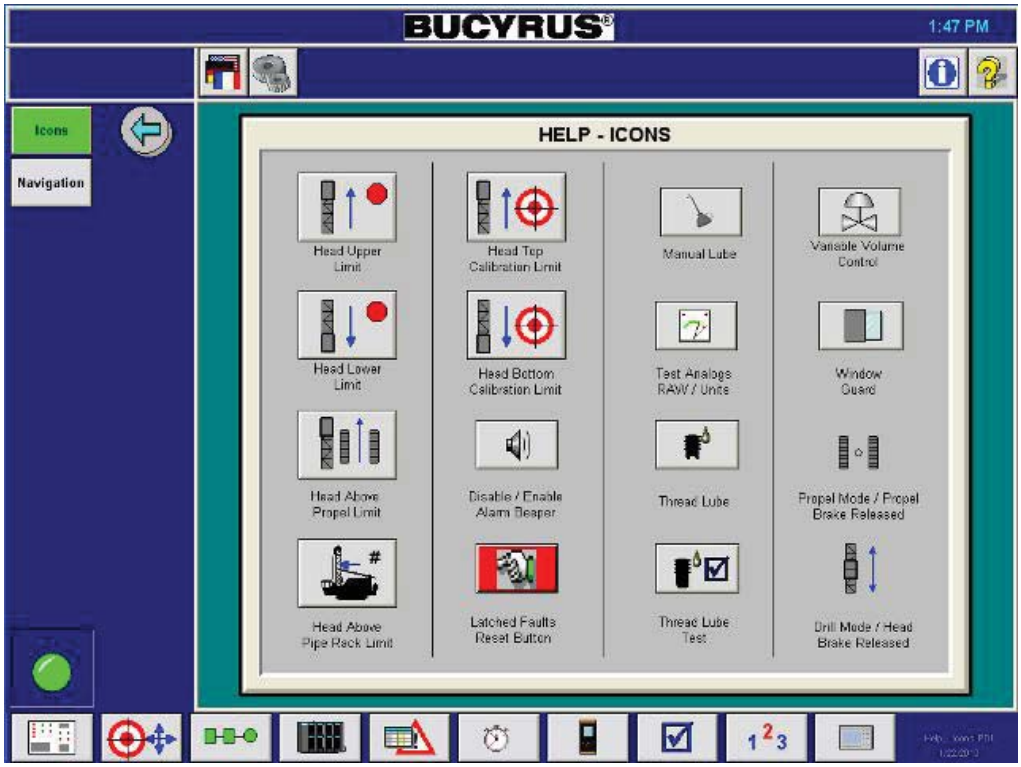


Figure 4 – Icon Help Screen Sample

Security

Since some of the screens contain setup parameters that may impact performance of the drill, it is not always desirable for all users to have access to all screens. Therefore, the parameter screens that are not required for day to day operation are protected by a three to five digit security code. The Administrator password has access to all screens. User 1 has access to all screens except the Setup screen. Each of the other users has access to one screen as shown in the Password Setup section.

When a user attempts to access a secure screen, the Password Entry window will pop up. Figure 5 shows a typical Password Entry window.

Leveling Screen Button

This button is located on the left side of the screen, the second of the four buttons in the submenu. It is used to change the screen to one that displays more detailed leveling and jack status information.

Maintenance Screen Button

This button is located on the left side of the screen, the third of the four buttons in the submenu. It is used to change the screen to one that displays maintenance related information such as lubrication system settings, air and oil temperatures, and cooler status.

Mast Operations Screen Button

This button is located on the left side of the screen, the fourth of the four buttons in the submenu. It is used to change the screen to one that displays mast pin locations, mast operating conditions, and winch settings.

Lubrication Setup Button

Below the lubrication timer table is the Lubrication Setup Button. Pressing this button toggles the lubrication setup mode which performs two functions. First, it performs the same function as holding the manual lube button down continuously. Second, this mode disables the lube system low pressure and vent pressure faults. When active, the background of this button will turn green.

Hour Meters and Fault Counters Screen

The Operating Hours & Fault Counters screen shows the length of time certain machine functions have been operating, as well as some cumulative hole and fault data (see Figure 16). This data can provide the maintenance and service personnel with a cumulative fault count of areas that may be experiencing problems. The accumulation interval can be controlled by manually resetting the counters at pre-established intervals and keeping records of machine performance during those intervals.

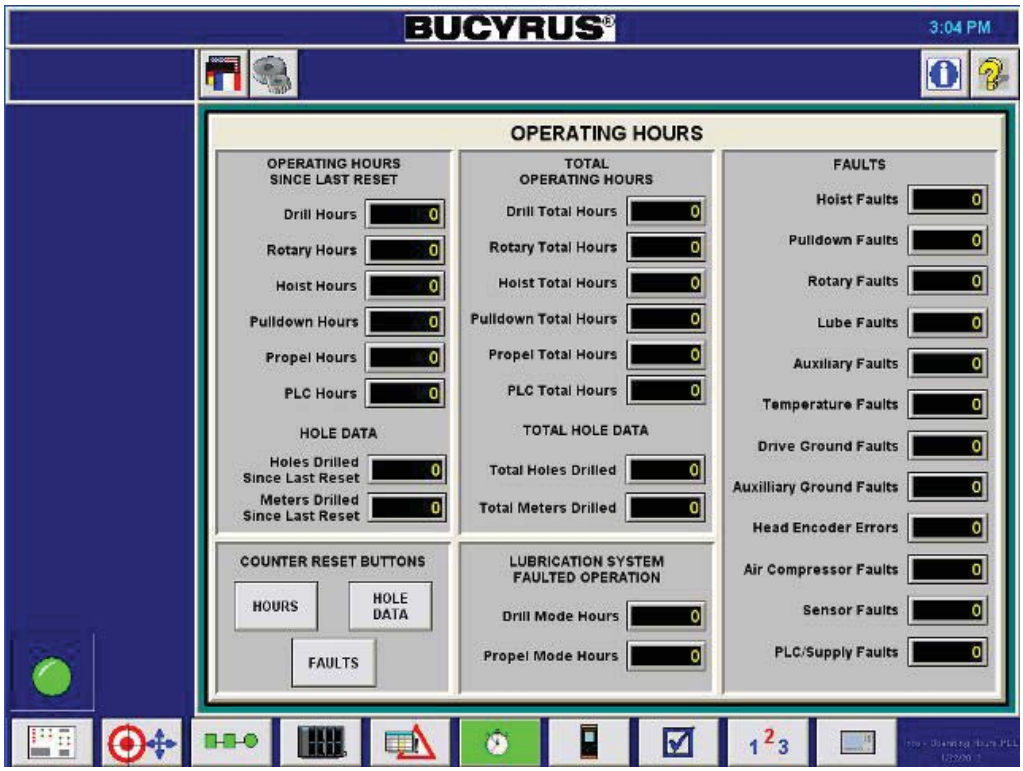


Figure 16 - Hour Meters & Fault Counters Screen

Total Operating Hours Section

The top middle section of the screen shows the total number of hours the drill has been powered on, the total number of hours spent operating the hoist and rotary motors, total hours propelling and the total number of hours the PLC has been turned on. The total number of holes drilled and total distance drilled is also displayed. It is not possible for the user to reset these values, however, they may be lost if the PLC program is reloaded.

NOTE: Only one button for each signal can be active at any given time. In addition, leaving the Hydraulic Card Setup Screen will disable all active signals being forced by these buttons.

Test Screens (Test – Analog I/O)

The Test Screens are accessible from the Test – Analog I/O Button on the Main Menu. These screens display all of the analog input and output values as they are read by the PLC. Two screens are available to display analog inputs (see Figure 23) while another screen displays analog outputs (see Figure 24). These screens are useful for testing the drills control system to determine where problems may exist.

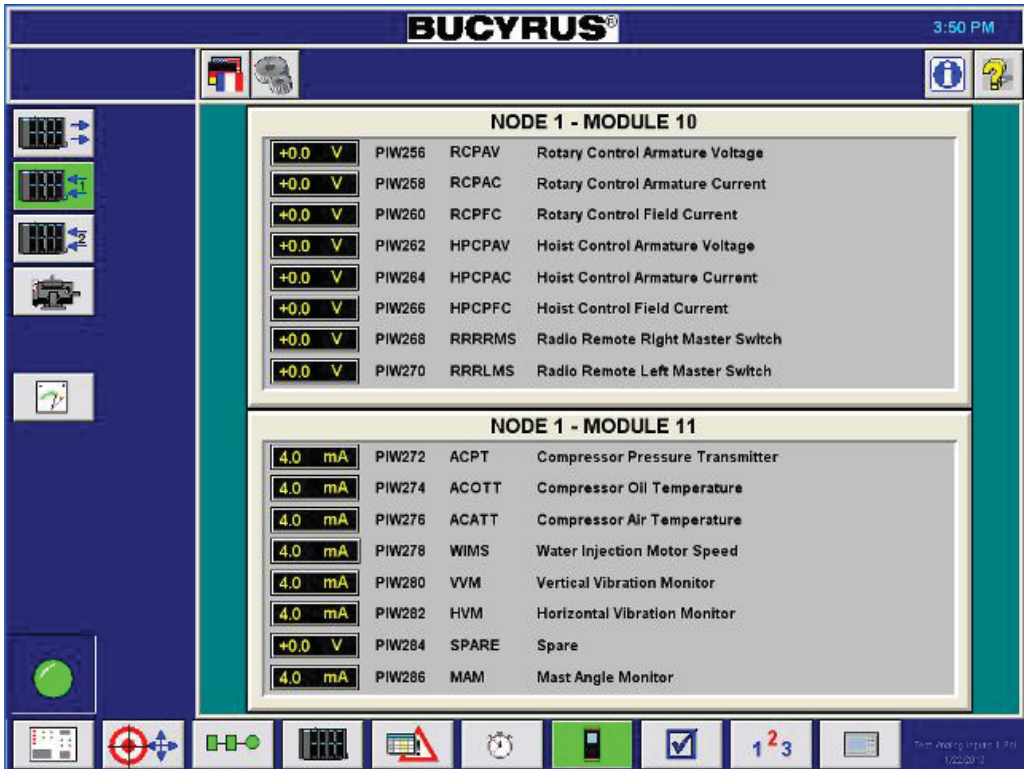


Figure 23 - Test Screen Analog Inputs 1 (Units View)

to be changed. In the raw mode, signals normally have a range of ±32767 including over-range values. This range is reduced to ±27648 for the full range.

View Voltage/Current – View Integer Button

This button is located on the left side of the screen at the bottom of the sub-menu, and toggles the display between showing the voltage or current measured at the card's terminals and the integer signal in the PLC. Changing the view on one screen will change it on all screens that use this feature.

Timers/Counters Screen

This screen is accessible from the Main Menu (see Figure 30). It allows the user to view the preset and time values of the timers and the current count of the counters in the PLC. In order to use this screen, it is necessary to know the timer or counter address, which can be found in the PLC software documentation.

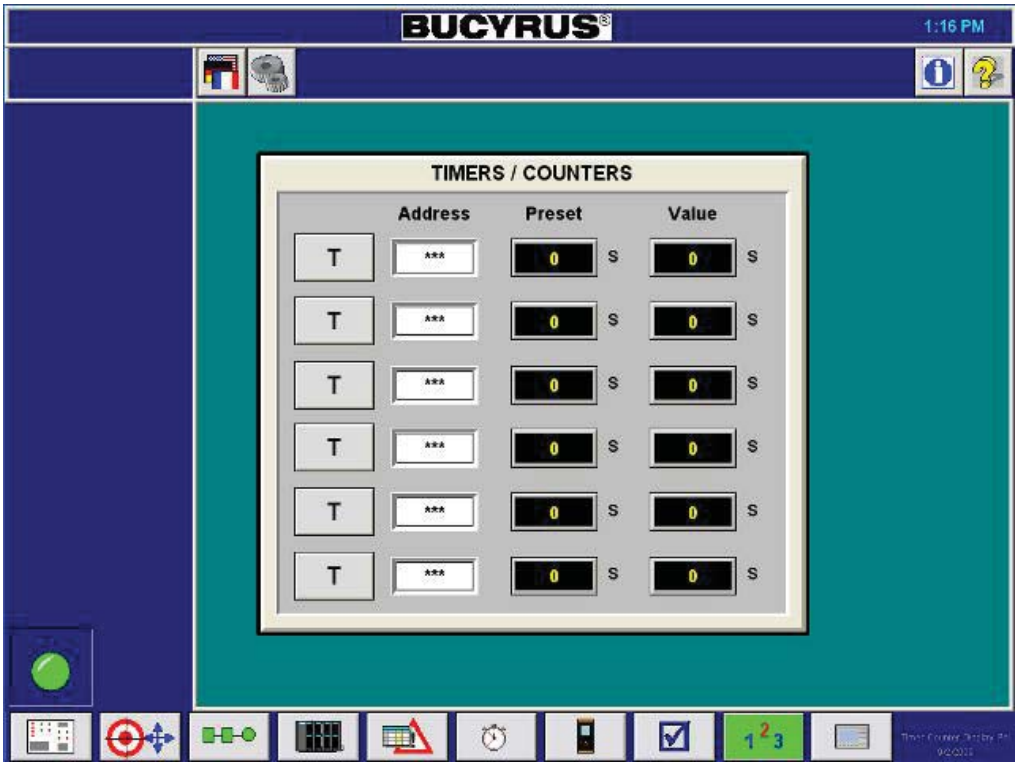


Figure 30 - Timers/Counters Screen

Entering Addresses

Once the address is known, perform the following steps to display the values.

Touch the Timer/Counter box in the first column to select either "T" for Timer or "C" for Counter. These values toggle back and forth.

Enter the address number in the second box. This will completely specify the desired timer or counter.

Appendix A – ANF Messages

The following table is a representative list of the fault and alarm conditions along with their ANF numbers. These faults will appear on the Active Alarms Screen when the associated condition is present and will stay active until the condition is corrected and the Fault Reset Button is pressed by the operator (see Alarms, Faults, and Messages section). Note that the actual list may differ due to options or version.

Alarm	Message
ANF000	Emergency Stop Active
ANF001	Emergency Stop Circuit Fault
ANF002	Operator Control Screen Communication Fault
ANF003	Spare
ANF004	Spare
ANF005	Spare
ANF006	Hydraulic Oil Overtemperature
ANF007	Hydraulic Oil Filter Clogged
ANF008	Hydraulic Oil Cooler Control Fault
ANF009	Hydraulic Tank Oil Level Sensor Fault
ANF010	Phase Sequence Line Fault
ANF011	Auxiliary Ground Fault
ANF012	Rotary Motor Blower Control Fault
ANF013	Rotary Input Power Fault
ANF014	Rotary Stall Fault
ANF015	Rotary Drive Incomplete Sequence
ANF016	Rotary Drive Internal Fault
ANF017	Rotary Field Loss
ANF018	Rotary Field Overcurrent
ANF019	Hoist/Pulldown Drive Internal Fault
ANF020	Hoist/Pulldown Field Loss
ANF021	Hoist/Pulldown Field Overcurrent
ANF022	Hoist/Pulldown Motor Blower Control Fault
ANF023	Hoist/Pulldown Input Power Fault
ANF024	Hoist/Pulldown Stall Fault
ANF025	Hoist/Pulldown Drive Incomplete Sequence
ANF026	House Fan Fault
ANF027	Water Injection Drive Fault
ANF028	Water Injection Low Water Level
ANF029	Drill Mode Low Lube Pressure
ANF030	Propel Mode Low Lube Pressure
ANF031	Lubrication System Vent Fault
ANF032	Drill Bit Lubrication Level Low
ANF033	Jacks Not Retracted in Propel Mode
ANF034	Air Compressor Oil Pump Start Failure
ANF035	Air Compressor Failure
ANF036	Air Compressor Oil Cooling Failure
ANF037	Air Compressor High Air Temperature Fault
ANF038	Air Compressor Oil Pressure Switch Fault
ANF039	Air Compressor High Oil Temperature Fault
ANF040	Air Compressor Oil Cooler Fan Control Fault
ANF041	Air Compressor Control Fault

Allen-Bradley

Bulletin 161 AC Drive (Series B)

0.2-3.7 kW (0.3-5 HP)

Firmware 2.001

User Manual

Rockwell Automation

Power terminal block wiring specifications

Model	Screw Size	Max/Min Wire Size mm^2(AWG)	Max/Min Torque Nm (lbin)
AA01-AA02	M3.5	2.1 – .75 (14-18)	0.9-0.8 (8.0-7.0)
AA03	M3.5	2.1 – 1.3 (14-16)	0.9-0.8 (8.0-7.0)
AA04, DA01	M4	5.3 – 1.3 (10-16)	1.3-1.2 (11.5-10.6)
AA05-AA10, DA02-DA03	M4	5.3 – 2.1 (10-14)	1.3-1.2 (11.5-10.6)
AA15	M4	5.3 – 3.3 (10-12)	1.3-1.2 (11.5-10.6)

Power Terminal Connection

IMPORTANT:

- Bulletin 161 Drives feature an electronic overload protection to monitor the motor current. In the case of multi-motor operation, thermal contacts or PTC resistors must be used for each motor.
- In the case of motor lead lengths greater than 50 meters (165 feet), motor reactors should be used.

Branch Circuit Protection Devices

The following table shows the minimum recommended values for the branch circuit protection devices:

	Fuse Rating (Class J)		Bulletin 140	
Model	1 Ph	3 Ph	1 Ph	3 Ph
AA01	10	10	140M-D8N-C10	140M-D8N-B40
AA02-AA03	10	10	140M-D8N-C10	140M-D8N-B63
AA04-AA05	15	15	140M-D8N-C16	140M-D8N-C10
AA07	20	15	140M-D8N-C16	140M-D8N-C16
AA10	30	20	140M-D8N-C25	140M-D8N-C16
AA15	N/A	30	N/A	140M-D8N-C25
DA01	10	N/A	140M-D8N-C10	N/A
DA02	15	N/A	140M-D8N-C10	N/A
DA04	20	N/A	140M-D8N-C16	N/A

Input Power Conditioning

The drive is suitable for connection to input power within the rated voltage of the drive (see specifications). The power factor of the input power supply must not exceed .99. Compensation systems must ensure that over compensation does not occur at any time.

If the drive must be installed in any of the following conditions, an Input Line Reactor must be used:

Input Power Condition	Corrective Action
Line has intermittent noise spikes in excess of 2000V	Install 3% impedance Input Line Reactor
If frequent voltage dips occur	Install 3% impedance Input Line Reactor
The drive is operated on a generator	Install 3% impedance Input Line Reactor
Line has power factor correction capacitors	Install 3% impedance Input Line Reactor
Several drives are linked via a short common power supply bus bar.	Install 3% impedance Input Line Reactor

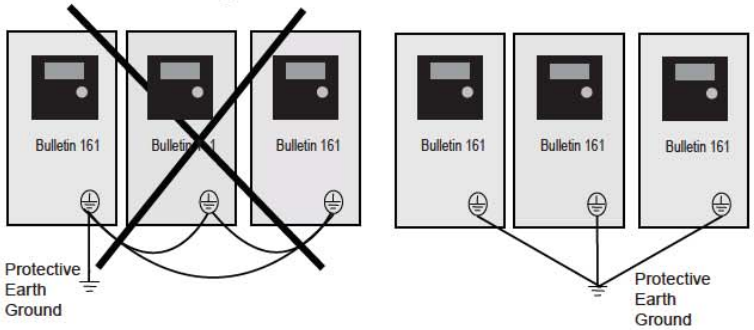
Grounding

ATTENTION

- **The Bulletin 161 has a high leakage current and must be permanently (fixed) hard wired to ground. Failure to observe this precaution could result in severe bodily injury or loss of life.**

Ground the drive. Be sure to separate the drive's grounding pole from those of other electrical machinery. If multiple drives are used, make certain grounding connections do not create a loop as shown in Fig. 2.5.

Figure 2.5 Suggested 161 Grounding



Parameter Descriptions

D Group - Display and Diagnostic Parameters (Read Only)

This group of parameters consists of commonly viewed drive operation conditions such as output frequency. All parameters in this group are Read Only.

Parameter Number	Parameter Name / Description	Min./Max. Range	Units
Display and Diagnostic Functions			
d01	**[Output Frequency]** Displays the output frequency to the motor.	0.0/360.0	0.1 Hz
d02	**[Output Current]** Displays the output current to the motor.	0.00/999.9	0.01A
d03	**[Direction]** Displays the present direction of rotation. F=Forward r=Reverse o=Stop	Alpha Numeric Value	Alpha Numeric Value
d04	**[PID Process Display]** Displays the scaled PID Process variable (feedback), this is only available when the PID control is active. The scale factor is set using **PC**15 - [Digital Input 5 Logic].	0/100.0	0.01%
d05	**[Digital Input Status]** Displays the status of the 5 digital inputs regardless of how each input is programmed in **P**C11 - [Digital Input 1 Logic] through **P**C15 - [Digital Input 5 Logic]. 5 4 3 2 1  *Active* *Inactive*	N/A	N/A
d06	**[Output Status]** Displays the status of the digital outputs and the fault indication relays. AL12 11  *Active* *Inactive*	N/A	N/A
d07	**[Process Display** Displays **P**d01 - [Output Frequency] scaled by the variable set in **P**b86 - [Process Display Scale Factor]. *Note: If there are more than 4 digits, the LSB will be dropped.*	0.00/9999	0.01
d08	**[Last Fault]** Displays the last fault. The output frequency, motor current, and DC-bus voltage at the time of the last fault can be viewed by pressing the SELect key. If there has not been a fault or the register has been cleared, then --- will be displayed.	N/A	---
d09	**[Fault Register]** Displays the 2nd and 3rd fault, if there are no faults stored in this register, then --- will be displayed. To view the 3rd fault, press the SELect key.	N/A	---
d16	**[Elapsed Run Time]** Displays the elapsed running time of the drive. The elapsed running time is the displayed value x 10.	0/9999	10 hours

Parameters & Programming

Parameter Number	Parameter Name/Description	Min/Max Range	Units	Factor Default U[1]	Factor Default K[1]
Outputs 11, 12, FM, AL0-AI1					
C23	**[Output FM Select]** Sets the operation of the output FM. Settings: 00={A-F} (Analog Output Frequency) 01={A} (Motor Current) 02={D-F} (Digital Output Frequency) Refer to control inputs table in chapter 2 for setting descriptions..	00/02	Numeric Value	00	00
C31	**[Digital Output 11-12 Logic]** Sets the digital outputs to be NO or NC contacts. Settings: 00=NO contact (Active high) 01=NC contact (Active open)	00/01	Numeric Value	00	00
C32				00	00
C33	**[Fault Relay AL1 Logic]** Sets the fault relay to be either NO or NC contacts. Settings: 00 = NO contact (active high) 01 = NC contact (active open) Refer to control inputs table in Chapter 2 for setting descriptions.	00/01	Numeric Value	01	01
C41	**[Overload Alarm Threshold]** Sets the allowable overload level before digital outputs 11-12 change state when set to 03 {0L}.	0/200% of drive rating	0.01 A	100% of drive rating	100% of drive rating
C42	**[Above Frequency Accel Threshold]** Sets the frequency at which digital outputs 11-12 change state when set to 02 {FA2} if the drive is accelerating.	0.0/360.0	0.1 Hz	0.0	0.0
C43	**[Above Frequency Decel Threshold]** Sets the frequency at which digital outputs 11-12 change state when set to 02 {FA2} if the drive is decelerating.	0.0/360.0	0.1 Hz	0.0	0.0
C44	**[PID Deviation Threshold]** Sets the allowable PID Loop error before digital outputs 11-12 change state when set to 04 {OD}.	0.0/100%	+/- 0.1%	+/-3.0	+/-3.0
Communications				**U[1]**	**K[1]**
C70	**[Communication Command Select]** Selects the source of the communication command. Settings: 02 = Remote Operator 03 = RS485	02/03	Numeric Value	02	02
C71	**[Baud Rate]** Selects the Baud Rate for RS485 communication. Settings: 04 = 4800 bps 05 = 9600 bps 06 = 19200 bps	04/06	Numeric Value	04	04
C72	**[Drive Address]** Sets the drive node address on the RS485 network.	01/32	N/A	01	01
C79	**[Communication Error Select]** Selects the drives operation when a communication error (E60) occurs. Settings: 00 = Fault 01 = No Fault and continue operation	00/01	Numeric Value	00	00
C91	**Debug Mode** Used by Rockwell Automation field service personnel. **ATTENTION** If **P**C91-[Debug Mode] is set to 01 parameters **P**C92-**P**C95 are enabled. Changing parameters **P**C92-**P**C95 can lead to personal injury, death, or equipment damage. DO NOT CHANGE PARAMETERS **P**C91-**P**C95.				

[1] U = 60 Hz default settings, K = 50 Hz default settings. Settable using **P**b85 – [Factory Default Select]

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VOLUME II of II

System Operation, Testing & Adjusting Manual

MD6640 Blast Hole Drill

Serial Number DR612159

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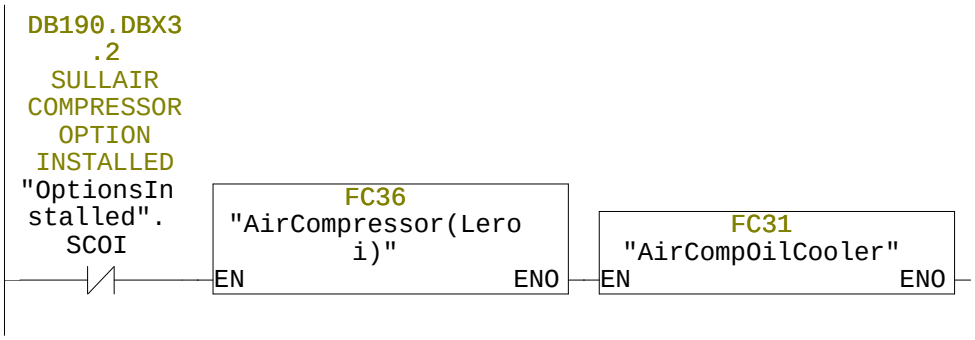
Cliffs - Bloom Lake
OB1

Network: 11

Down References
PUT OB1:3/SD

Network: 12 Air Compressor Control (Standard Leroi)

The networks called in this logic control the standard 3000CFM Leroi compressor on the 49HR.



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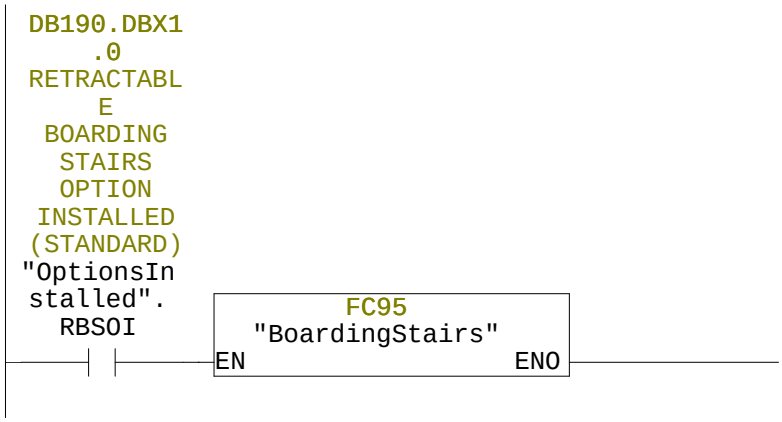
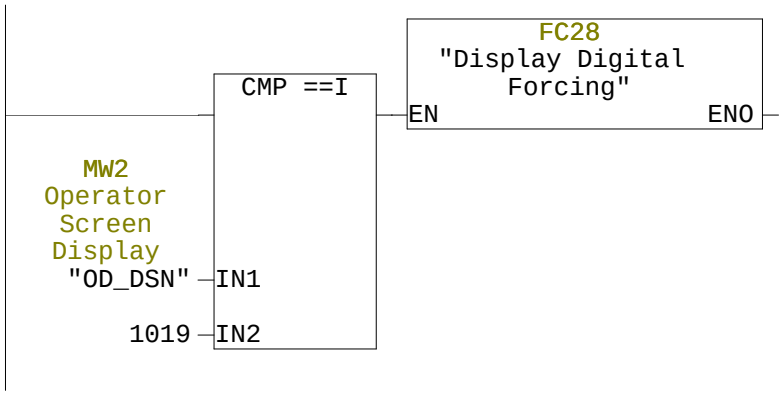
OB1

Network: 41 Retractable Boarding Stairs Control (Optional)



Network: 42 Digital Forcing Control



Down References
OD_DSN

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FC3

```
      JCN   F264                              //has built up to check for out of range
                                               fault.
      L     #RETVAL                                                  #RETVAL
      L     0
      <>I
      FR    "ORFT264"                                                T161
                                                                      -- OUT OR RANGE F
                                                                     AULT TIMER PIW264
      L     "Timers".t161                                            DB911.DBW320
                                                                      -- ORFT264 (1 s)
      SD    "ORFT264"                                                T161
                                                                      -- OUT OR RANGE F
                                                                     AULT TIMER PIW264
      O     "ORFT264"                                                T161
                                                                      -- OUT OR RANGE F
                                                                     AULT TIMER PIW264
      S     "FaultedConditions".ANF084                               DB1.DBX10.4
                                                                      -- PIW264 INPUT O
                                                                     UT OF RANGE (HOIST
                                                                     /PD ARMATURE CURRE
                                                                     NT)

F264: CALL  "Filter" , "FilterDB_HCPAC"                              FB501 / DB264
       raw_R            :=#PIW264_R                                  #PIW264_R
       time_K           :=5
       feedback_Real    :="FilterDB_HCPAC".                          DB264.DBD10
filtered_out_Real
       filtered_out_Real:="FilterDB_HCPAC".                          DB264.DBD10
filtered_out_Real

      L     "FilterDB_HCPAC".filtered_out_R                          DB264.DBD10
eal
      T     "AnalogInputsScaledData".HCPAC_                          DB607.DBD16
SCALED                                                                -- (PIW264) HOIST
                                                                      CONTROL ARMATURE
                                                                     CURRENT (-750 TO +
                                                                     750 ADC, + = HOIST
                                                                     )
      T     "DisplayWords_PLC2HMI".HAC                               DB1002.DBD288
                                                                      -- Hoist Armature
                                                                      Current
```

Down References

ALWAYS_ON	OB1:1/S
HPMFTR	FC43:8/SD
ORFT264	FC3:5/FR

Up References

ORFT264	FC3:5/O

```
      L     "FilterDB_VVM".filtered_out_Rea                    DB280.DBD10
l
      T     "AnalogInputsScaledData".VVM_SC                    DB607.DBD48
ALED                                                            -- (PIW280) VERTI
                                                               CAL VIBRATION METE
                                                               R (0 - 10 IPS)
      O     "DisplayBits_HMI2PLC".ULF                          DB1001.DBX7.1
                                                               -- Units Length F
                                                               eet
      JCN   D280
      T     "DisplayWords_PLC2HMI".VV                          DB1002.DBD128
                                                               -- Vertical Vibra
                                                               tion
      JU    E280
D280: L     "FilterDB_VVM".filtered_out_Rea                    DB280.DBD10
l
      L     2.540000e+000
      *R
      T     "DisplayWords_PLC2HMI".VV                          DB1002.DBD128
                                                               -- Vertical Vibra
                                                               tion

E280: NOP   0
```

Down References

ALWAYS_OFF	OB1:2/R
ORFT280	FC3:13/FR

Up References

ORFT280	FC3:13/O

Network: 14 PIW282 HVM_SCALED

HORIZONTAL VIBRATION METER

INPUT: 4 - 20 mA
OUTPUT: 0 - 10 INCHES/SEC = 0 - 25.4 CM/SEC (IN X 2.54 = CM)

```
      CALL  "SCALE"                                             FC191
                                                                -- Scaling Values
       IN     :="HVM"                                          PIW282
                                                                -- HORIZONTAL VIB
                                                                RATION METER
       HI_LIM :=1.000000e+001
       LO_LIM :=0.000000e+000
       BIPOLAR:="ALWAYS_OFF"                                    M0.0
                                                                -- Always off
       RET_VAL:=#RETVAL                                         #RETVAL
       OUT    :=#PIW282_R                                       #PIW282_R
```

Down References
ALWAYS_ON OB1:1/S
ORFT298 FC3:22/FR

Up References
ORFT298 FC3:22/O

Network: 23 PIW300 PORMS_SCALED

PROPEL RIGHT MASTER SWITCH

INPUT: -10 TO +10 VDC
OUTPUT: -100 TO +100%

```
      CALL  "SCALE"                                          FC191              -- Sc
                                                             aling Values
       IN     :="PORMS"                                      PIW300             -- PR
                                                             OPEL RIGHT MASTER SWITCH
       HI_LIM :=1.000000e+002
       LO_LIM :=-1.000000e+002
       BIPOLAR:="ALWAYS_ON"                                  M0.1               -- Al
                                                             ways On
       RET_VAL:=#RETVAL                                      #RETVAL
       OUT    :=#PIW300_R                                    #PIW300_R

      L     #RETVAL                                          #RETVAL
      L     0
      <>I
      FR    "ORFT300"                                        T179               -- OU
                                                             T OF RANGE FAULT TIMER P
                                                             IW300
      L     "Timers".t179                                    DB911.DBW356       -- OR
                                                             FT300 (1 s)
      SD    "ORFT300"                                        T179               -- OU
                                                             T OF RANGE FAULT TIMER P
                                                             IW300
      O     "ORFT300"                                        T179               -- OU
                                                             T OF RANGE FAULT TIMER P
                                                             IW300
      S     "FaultedConditions".ANF102                       DB1.DBX12.6        -- PI
                                                             W300 INPUT OUT OF RANGE
                                                             (PROPEL RIGHT MASTER SWI
                                                             TCH)

      CALL  "Filter" , "FilterDB_PORMS"                      FB501 / DB300
       raw_R            :=#PIW300_R                         #PIW300_R
       time_K           :=2
       feedback_Real    :="FilterDB_PORMS".filtered_out_Real DB300.DBD10
       filtered_out_Real:="FilterDB_PORMS".filtered_out_Real DB300.DBD10

      L     "FilterDB_PORMS".filtered_out_Real               DB300.DBD10
```

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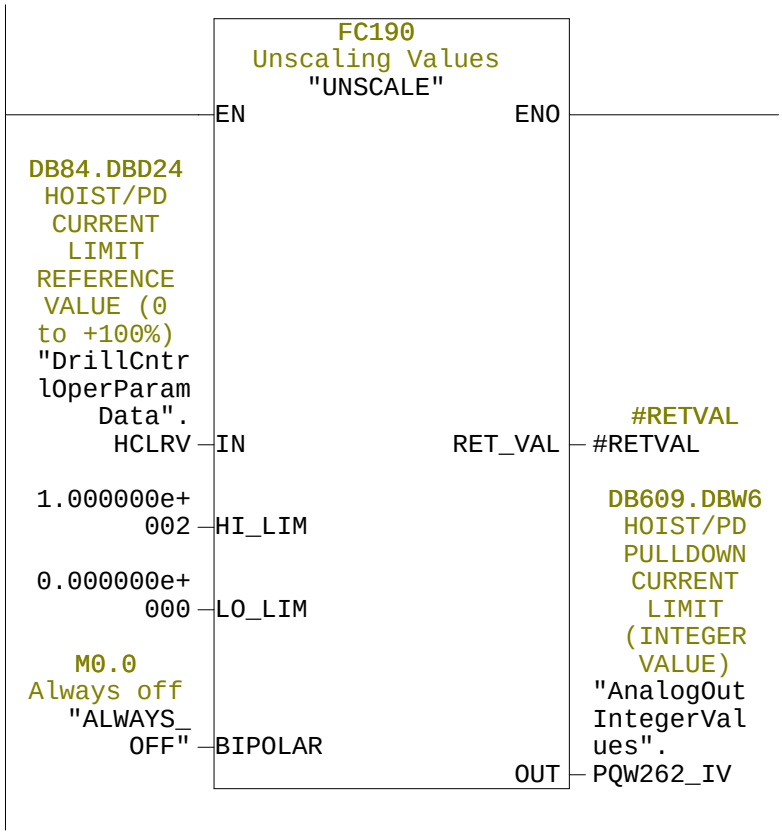
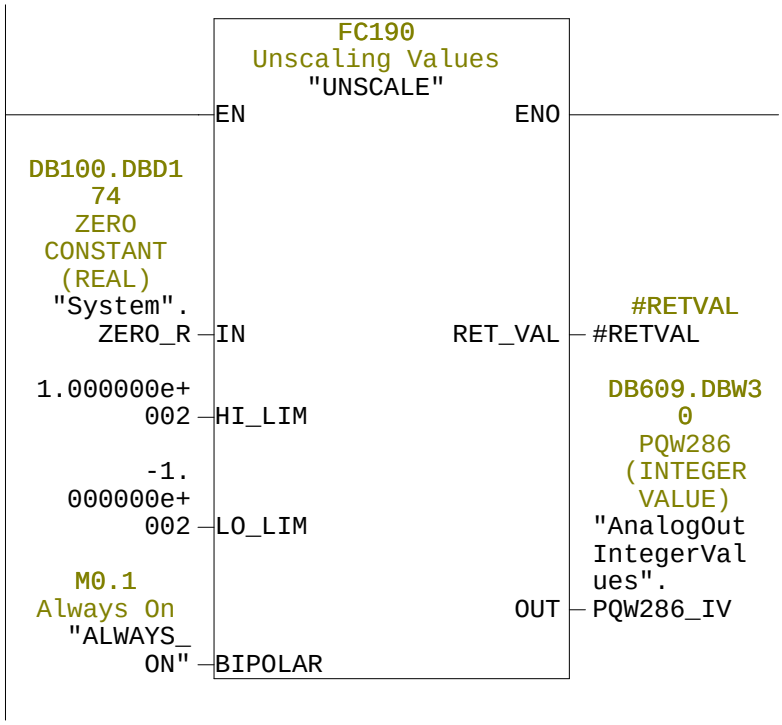
FC6

Network: 4 UNSCALE REAL VALUE FOR HOIST/PD CURRENT LIMIT (PQW262)



Down References
ALWAYS_OFF OB1:2/R

Network: 16 UNSCALE REAL VALUE FOR PWQ286 (SPARE)



Down References
ALWAYS_ON OB1:1/S

Network: 17

Down References
ALWAYS_ON OB1:1/S

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FC9

Down References
ESCFTR FC9:2/SD

Up References
ESCFTR FC9:2/A

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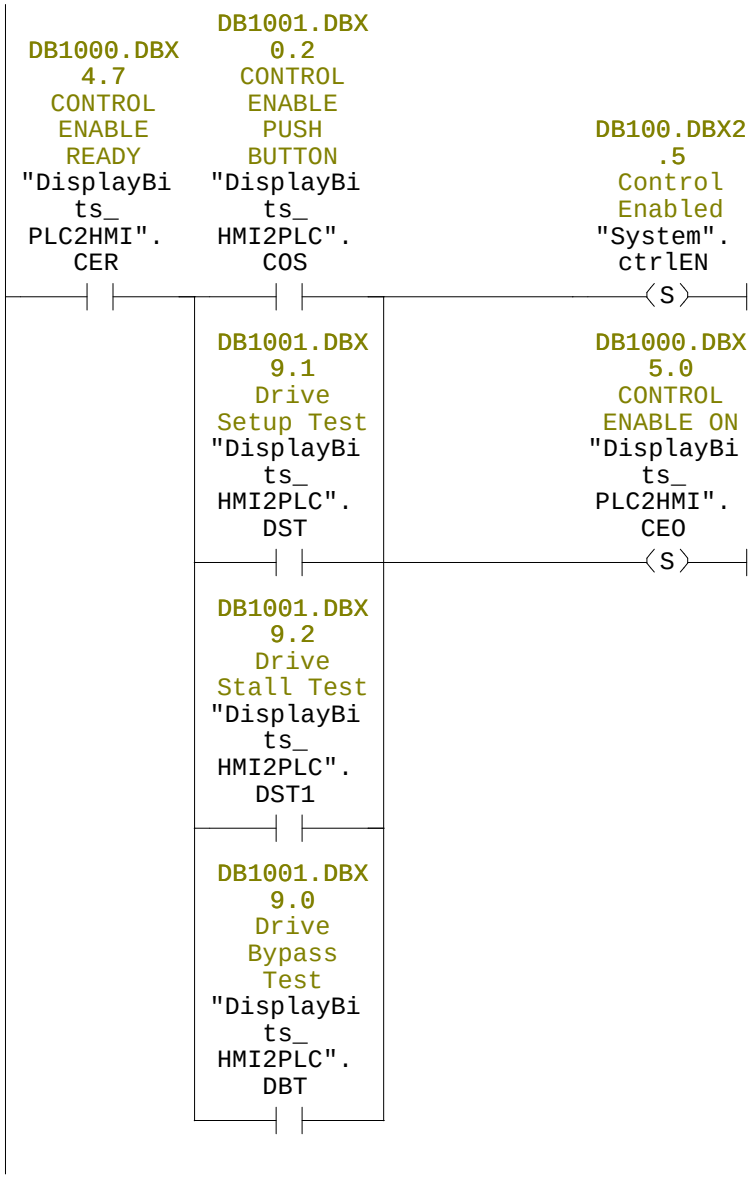
FC9

Network: 13 CONTROL ENABLE

WHEN THE SYSTEM IS READY AND THE HMI PB IS PRESSED CONTROL IS ENABLED. THIS WILL LATCH IN THE CONTROL ENABLED BIT AND TURN THE HMI PB A SOLID GREEN.

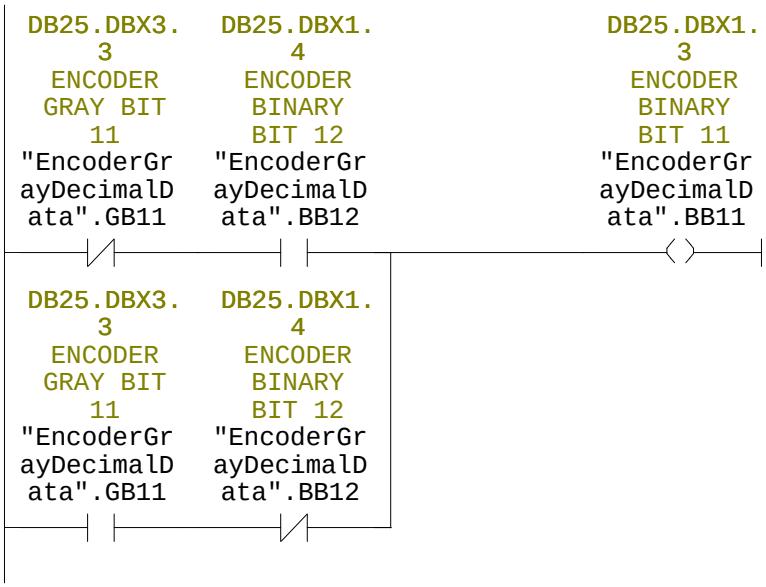
CONTROL IS ALSO ENABLED WHEN ANY OF THE DRIVE TEST BUTTONS ARE PRESSED SINCE THE OPERATOR/TESTOR CANNOT LEAVE THE DRIVE TEST SCREEN TO PRESS THE CONTROL ENABLE BUTTON.



Network: 14 ENCODER BIT BINARY BIT 12

NETWORKS 14-27 TAKE THE GRAY SCALE INPUT VALUE OF THE HEAD ENCODER AND CONVERTS IT TO A BINARY WORD VALUE.

Network: 15 ENCODER BIT BINARY BIT 11



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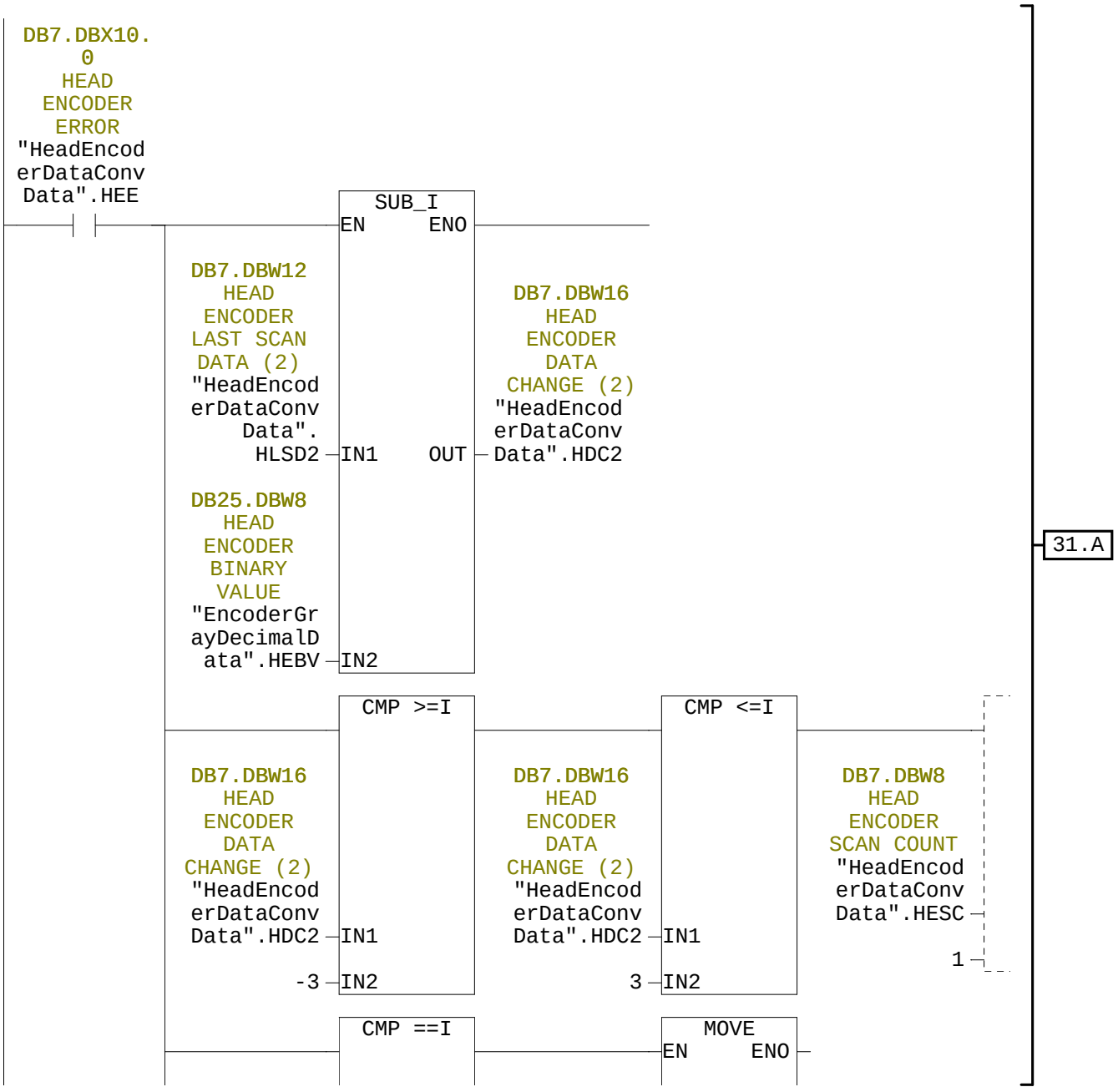
FC10

Network: 31

IF THE ERROR BIT IS SET, THE "LAST SCAN DATA 1" VALUE WILL NOT BE UPDATED (THEREBY KEEPING THE BIT ON AND KEEPING THE BUFFERED VALUE FROM CHANGING) UNTIL THE ENCODER HAS MAINTAINED A COUNT WITHIN +/- 3 FOR 8 SCAN CYCLES



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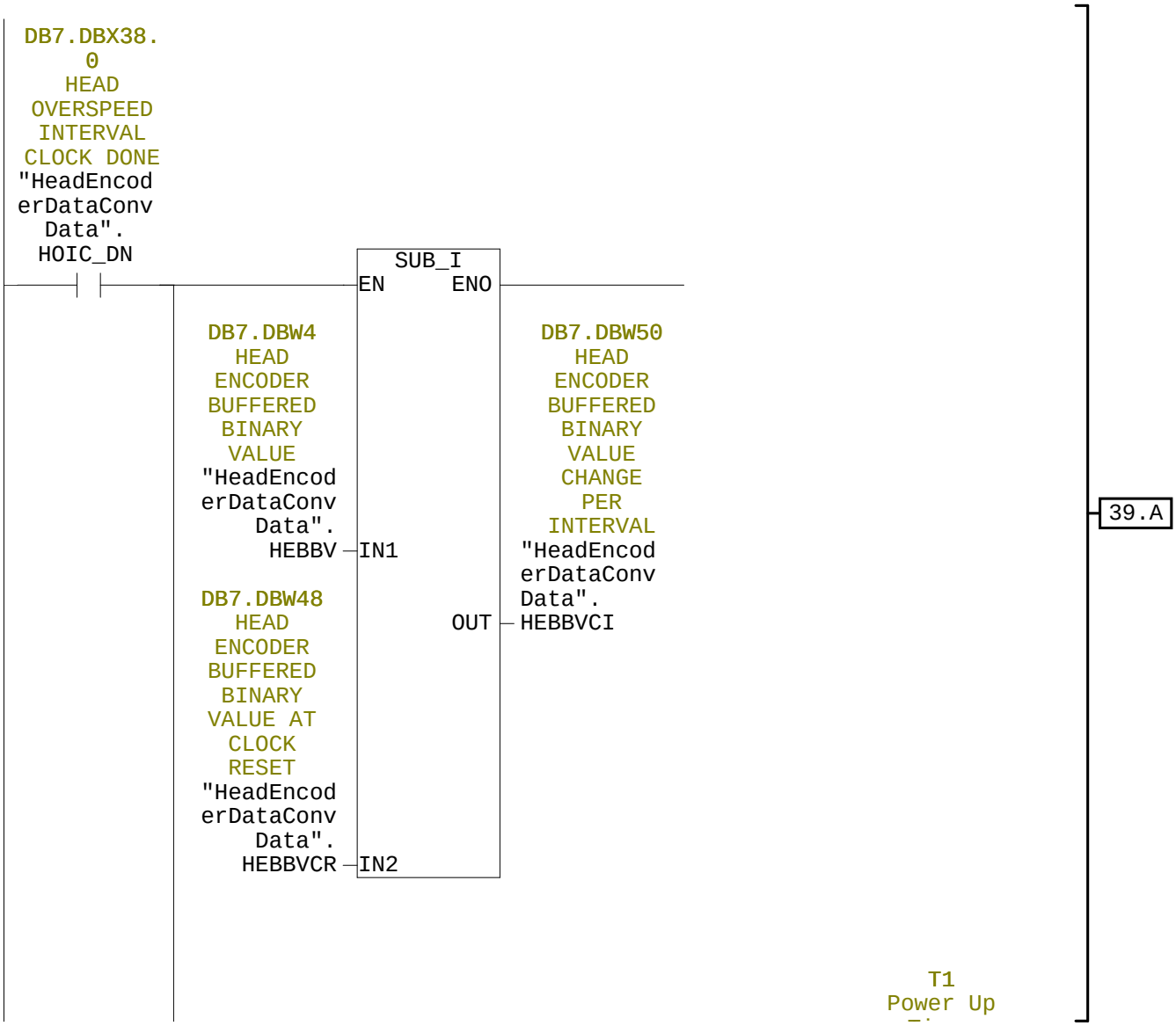
FC10

Network: 39 Head Overspeed Fault

If the encoder changes 7 counts within the interval timed above (75ms) then a head overspeed fault is set. This equates to a head speed of approximatly 1.6ft/s.

To avoid overspeed faults when the head encoder binary value jumps from 0 to 8192 or 8192 to 0 (13 bit encoder) in a rollover situation, the change in encoder value must be less than 8000 counts in order to throw an overspeed fault.



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FC11

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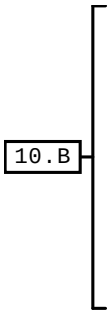
FC11



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FC11

13.B

13.D

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FC11

DB9.DBD42
PIPE RACK
LIMIT 4
COUNT
"HeadLimit
sData".
PRL4C — IN2

PIPE RACK
SELECTOR
SWITCH -
4TH RACK
"PRSS_4"

DB1001.DBX
11.2
Shop Test
3 -
Simulate
Head
Encoder
Position
Above
Pipe Rack
Limit
"DisplayBi
ts_
HMI2PLC".
ST3

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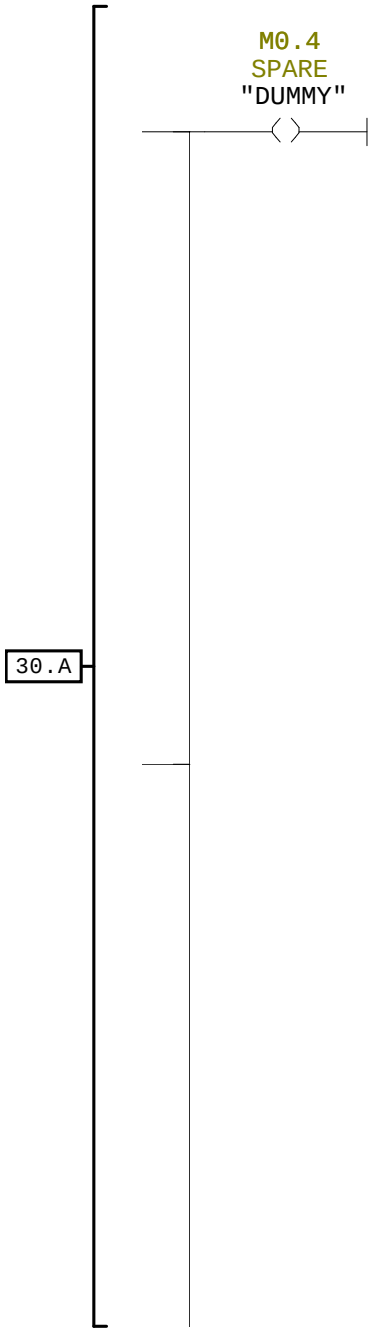
FC11



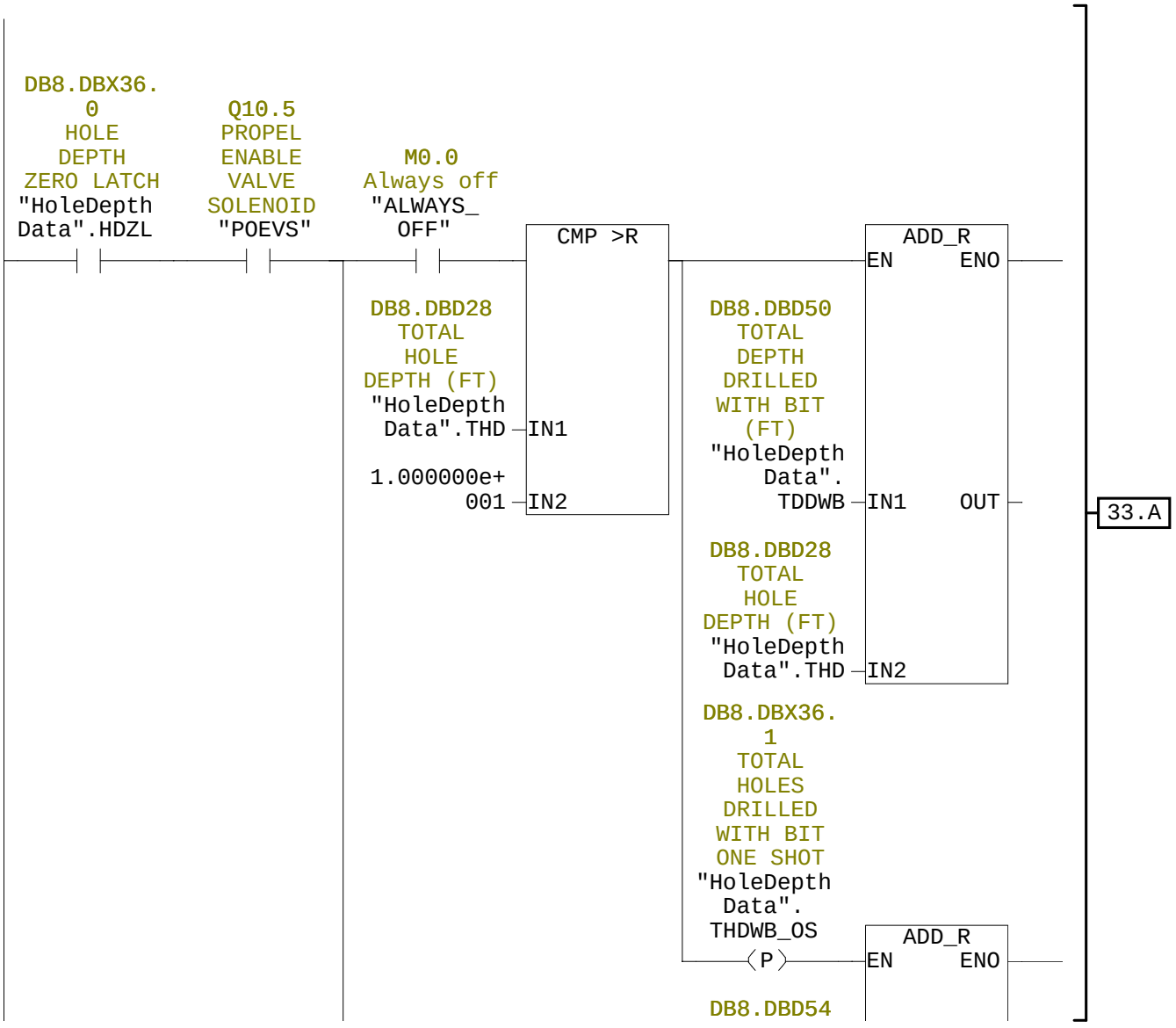
CBDR612159
Cliffs - Bloom Lake
FC11

Network: 33 UPDATE BIT DATA DEPTH AND HOLES DRILLED

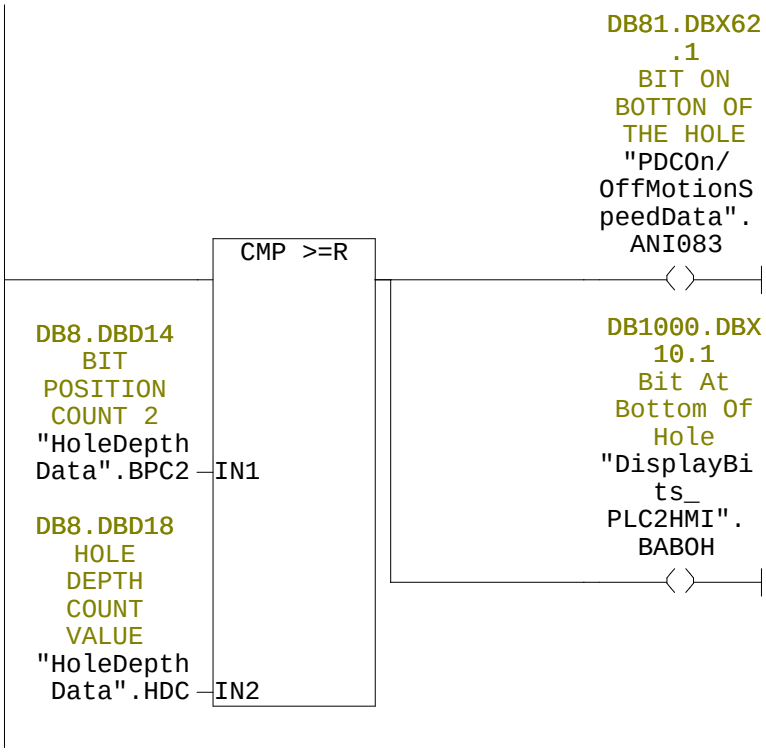
*** DISABLED UNTIL MORE DIRECTION IS GIVEN ***

NOTE: If this network is removed, the output to reset the HOLE DEPTH ZERO LATCH must be moved to the previous network.

WHEN HOLE IS COMPLETE AND THE DRILL IS PLACED IN PROPEL MODE, UPDATE THE BIT DATA DRILL DEPTH AND NUMBER OF HOLES VALUES. IF REQUIRED, CONVERT TO METERS BEFORE DISPLAY.



Network: 39 BIT ON BOTTON OF THE HOLE



Network: 40

Down References
ALWAYS_ON OB1:1/S

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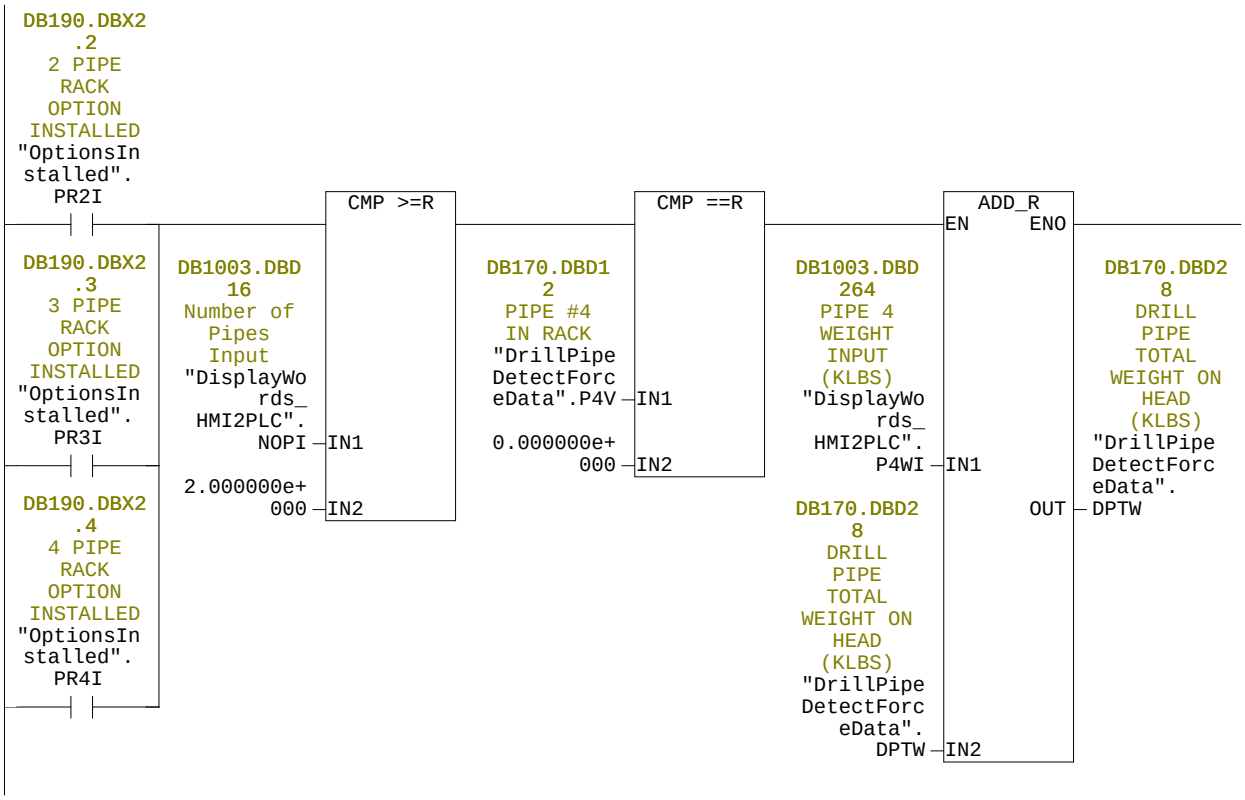
FC12

Network: 12



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FC30

FC30 - <offline>

"AirCompressor(Sullair)"

Name: **Family:**
Author: **Version:** 0.1
Block version: 2
Time stamp Code: 03/02/2012 01:42:52 PM
Interface: 05/27/2009 10:15:51 AM
Lengths (block/logic/data): 01482 01334 00002

Name	Data Type	Address	Comment
IN		0.0	
OUT		0.0	
IN_OUT		0.0	
TEMP		0.0	
RETURN		0.0	
RET_VAL		0.0	

Block: FC30 AIR COMPRESSOR OPERATION

THIS MODULE CONTROLS THE OPERATION OF THE MAIN AC MOTOR WHICH POWERS THE AIR COMPRESSOR AND THE HYDRAULIC PUMPS. THE MOTOR HAS BOTH HARDWIRED (TO THE PLC) START AND STOP PBs (LOCATED ON THE DOOR OF ITS MOTOR STARTER PANEL) AND A SOFT BUTTON ON THE HMI THAT WILL TOGGLE IT ON AND OFF WHEN PRESSED.

THE COMPRESSOR HAS AN EXTERNAL OIL PUMP WHICH NEEDS TO BE STARTED BEFORE THE MAIN MOTOR. WHEN A START SIGNAL IS RECEIVED, AND ALL PERMISSIVES ARE OK, THE OIL PUMP STARTER IS ENERGIZED. WHEN THE AUX CONTACT FROM ITS STARTER IS PULLED IN A SHORT DELAY IS PROVIDED TO ALLOW PRESSURE TO BUILD THEN THE MAIN MOTOR IS STARTED.

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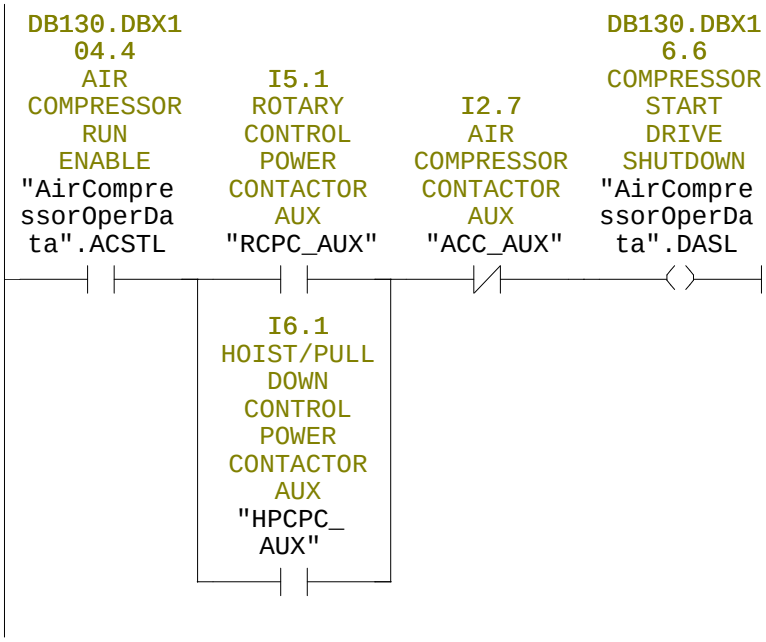
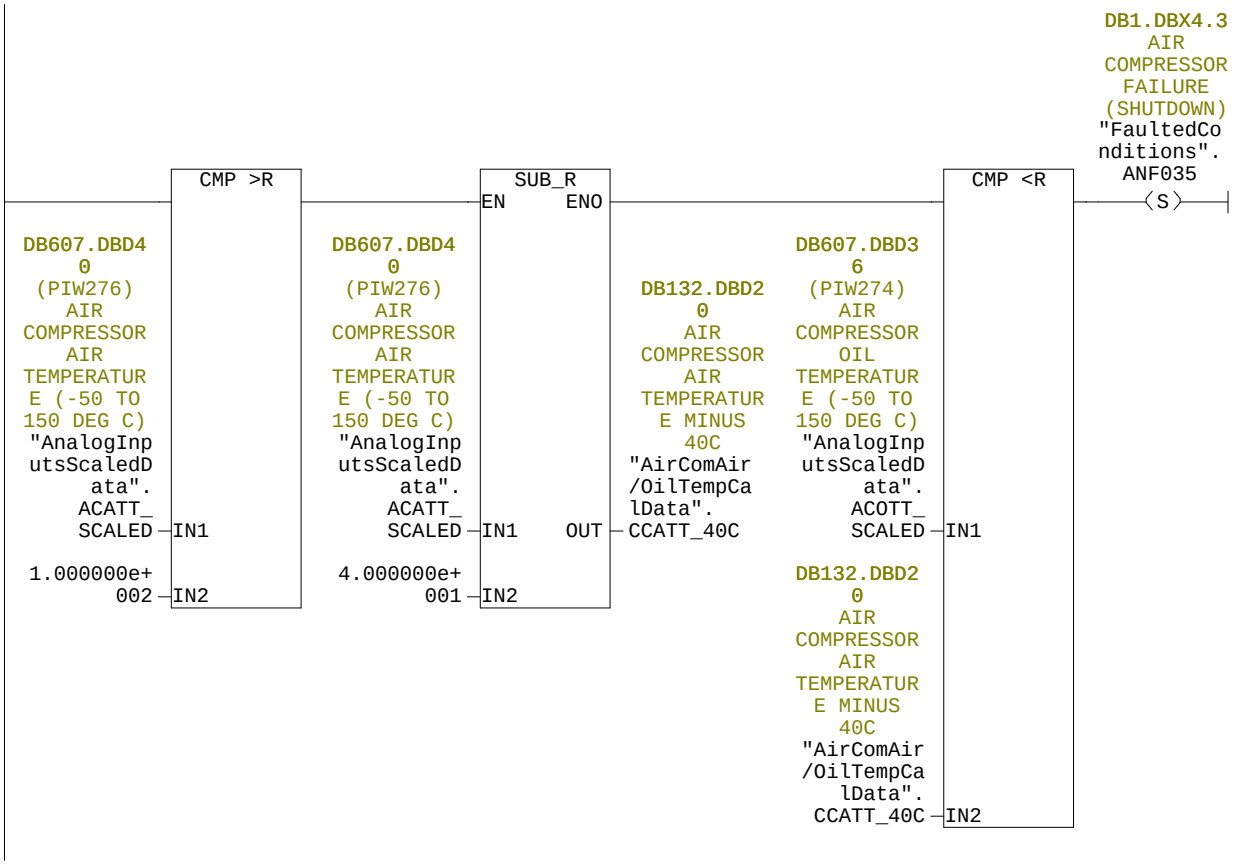
FC30

Network: 8 COMPRESSOR START DRIVE SHUTDOWN
IF EITHER OF THE DC DRIVES ARE RUNNING, THIS BIT WILL SHUT THEM DOWN BEFORE STARTING THE COMPRESSOR. THIS IS DONE TO PREVENT POWER ISSUES AT THE DRIVES RELATED TO THE LARGE INRUSH WHEN THE MAIN MOTOR IS STARTED.



Network: 20 COMPRESSOR FAILURE (SHUTDOWN)

CATT > 100 DEGREES C (212F), COTT < (CATT - 40C)



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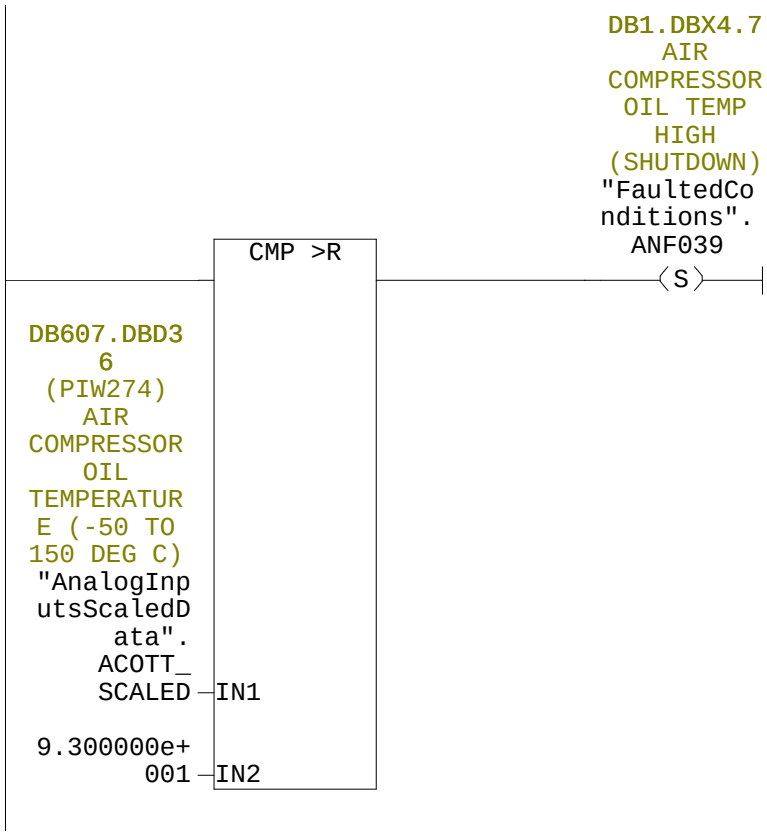
FC31

Network: 6 AIR COMPRESSOR OIL TEMP HIGH FAULT (SHUTDOWN)

ACOTT > 93 deg. C (200 deg. F)



Network: 7

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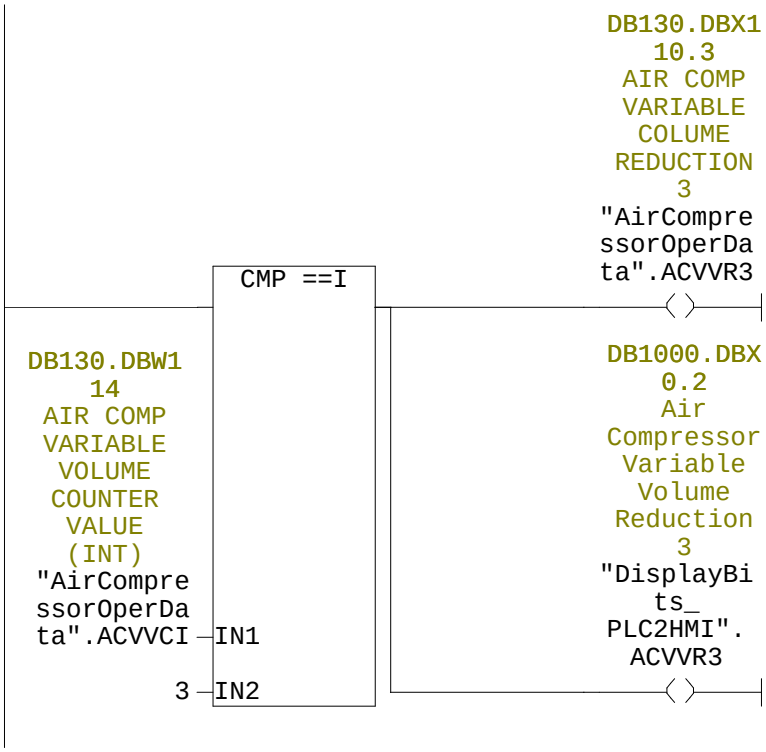
FC33

Network: 5 COMPRESSOR REDUCTION 3



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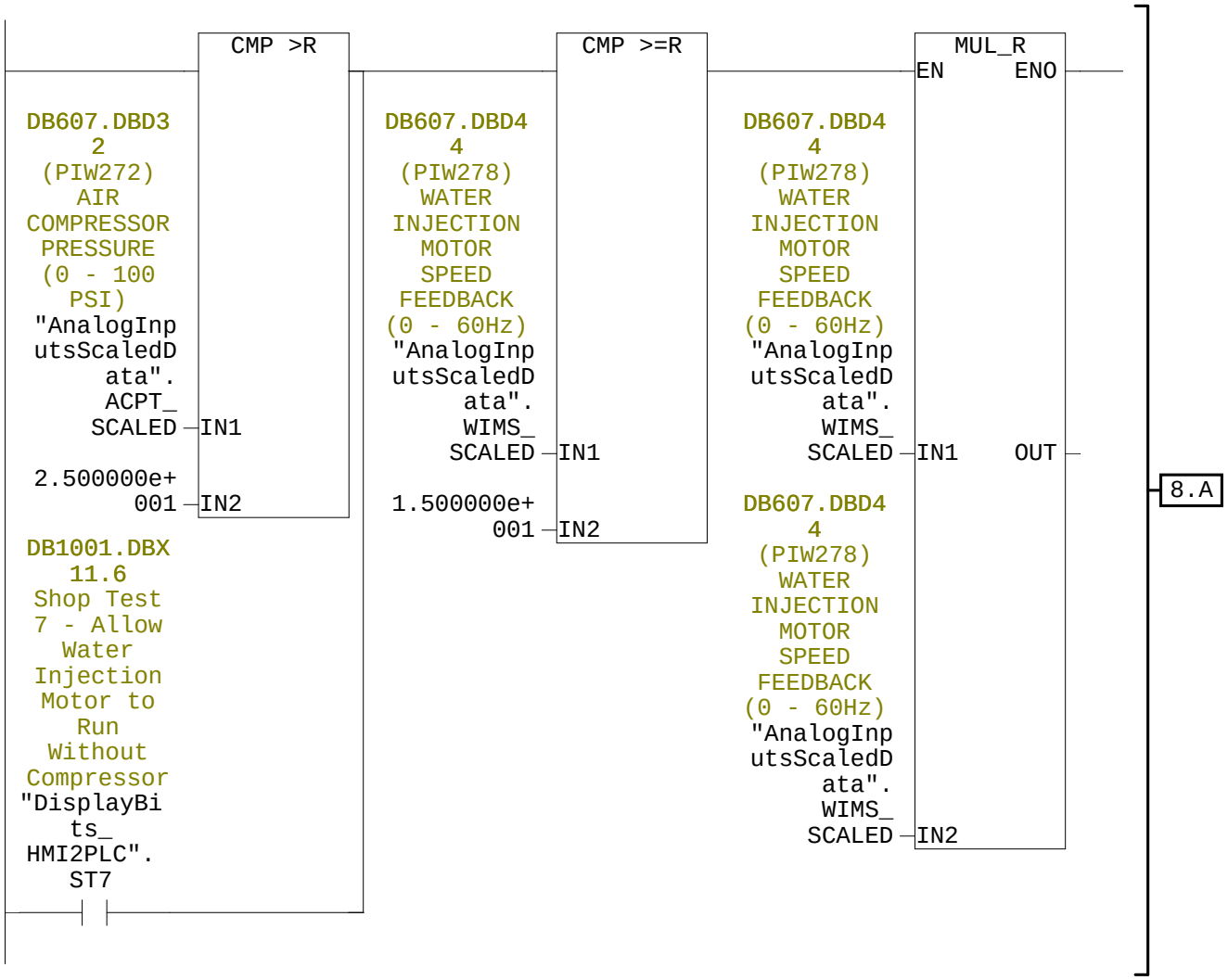
FC34

Network: 8 WATER INJECTION CALCULATED FLOW

WATER INJECTION FLOW RATE BASED ON MEASURED WATER INJECTION MOTOR SPEED UNDER CONTROLLED CONDITIONS. GPM = ((WIMS * WIMS) - 225.0) * 0.00320879



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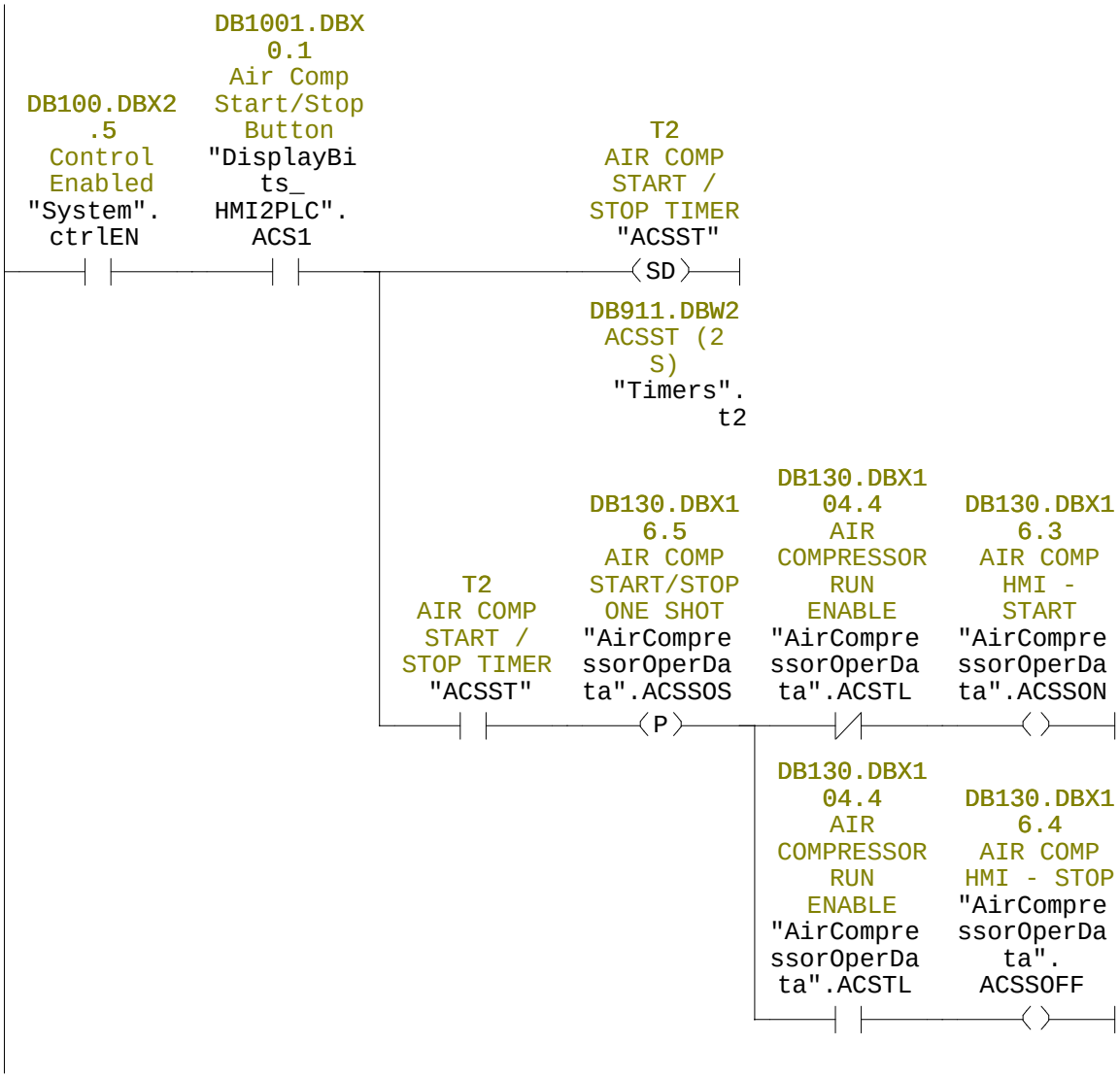
FC36

Network: 1 AIR COMPRESSOR START-STOP
IF THE HMI MAIN MOTOR ON-OFF BUTTON (MOMENTARY) IS PRESSED, IT WILL ACT AS A START REQUEST IF THE ENABLE BIT IS NOT ALREADY SET, OTHERWISE IT WILL ACT AS A STOP. NOTE: THE BUTTON MUST BE PRESSED FOR 2 SEC. BEFORE ACTIVATION (TO AVOID ACCIDENTAL OPERATION)



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FC36

Network: 10 COMPRESSOR INLET PRESSURE SWITCH LATCH

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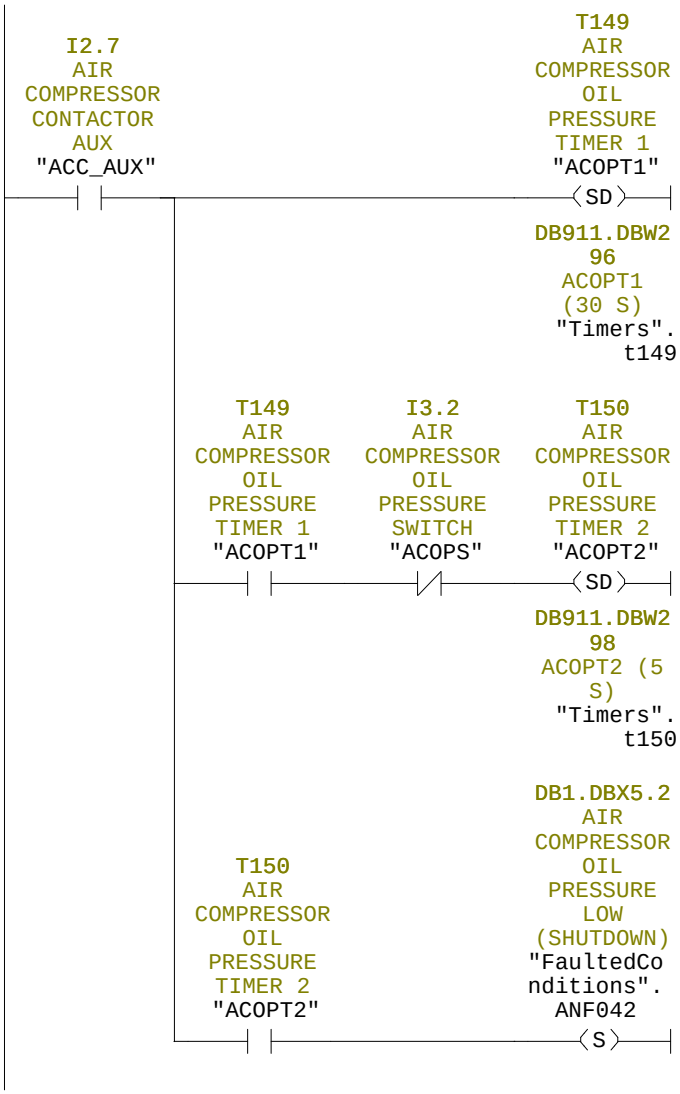
Cliffs - Bloom Lake
FC36

Down References
CFDAVT FC30:22/SD FC36:21/SD

Up References
CFDAVT FC30:22/AN FC36:21/AN

Network: 22 AIR COMPRESSOR OIL PRESSURE LOW FAULT
WAIT UNTIL THE AIR COMPRESSOR HAS BEEN RUNNING FOR 30 SEC, THEN BEGIN CHECKING THE OIL PRESSURE SWITCH AND IF IT STAYS TRIPPED FOR 5 SEC, LATCH THE LOW OIL PRESSURE FAULT.



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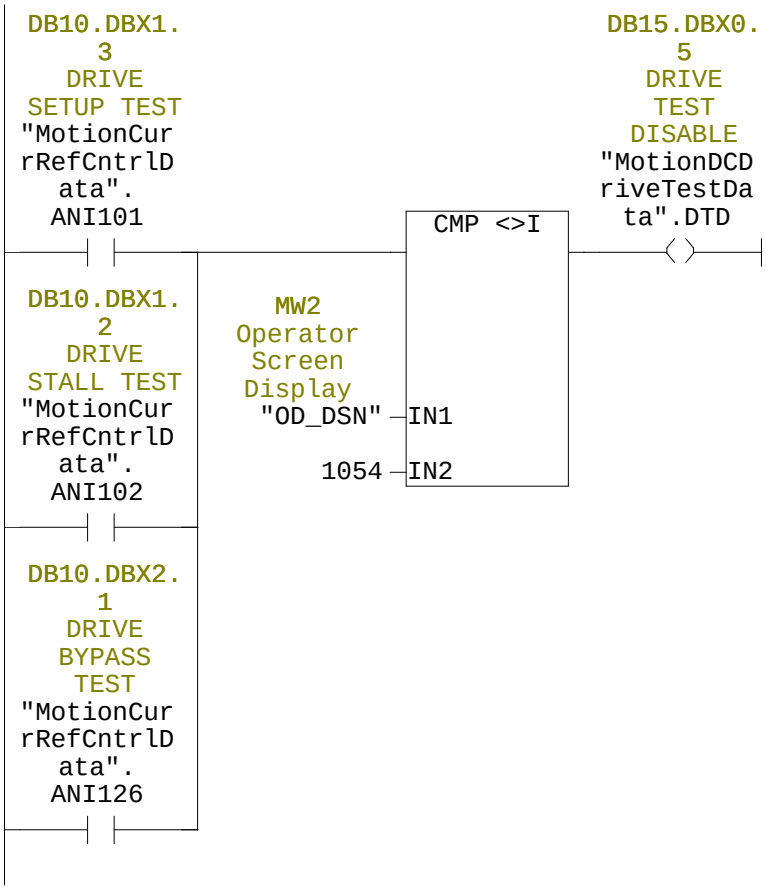
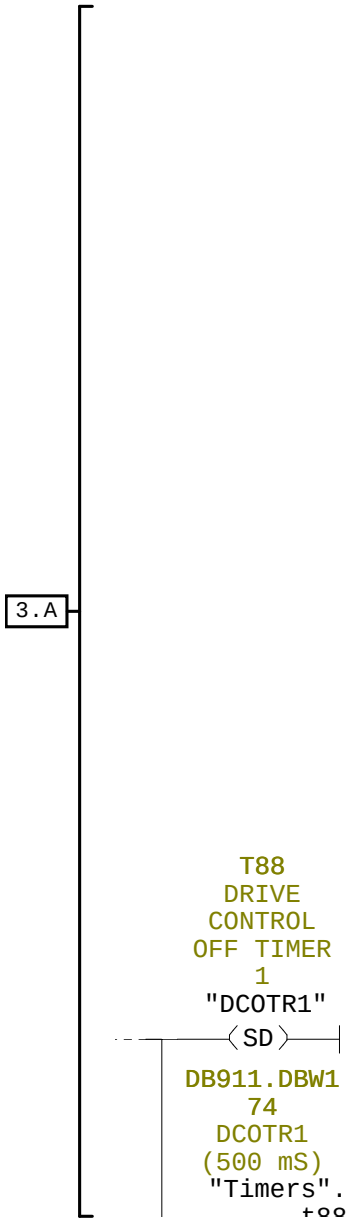
Cliffs - Bloom Lake
FC41

Network: 8 DRIVE TEST DISABLE
DO NOT ALLOW DRIVE CONTROL IF THE OPERATOR NAVIGATES AWAY FROM DRIVE TEST SCREEN WHILE A TEST IS ACTIVE.



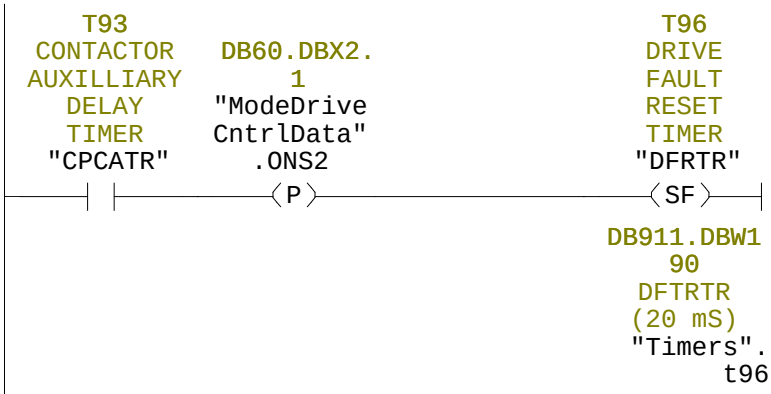
Down References
OD_DSN

CBDR612159
Cliffs - Bloom Lake
FC43



Down References
CPCATR FC43:9/SD

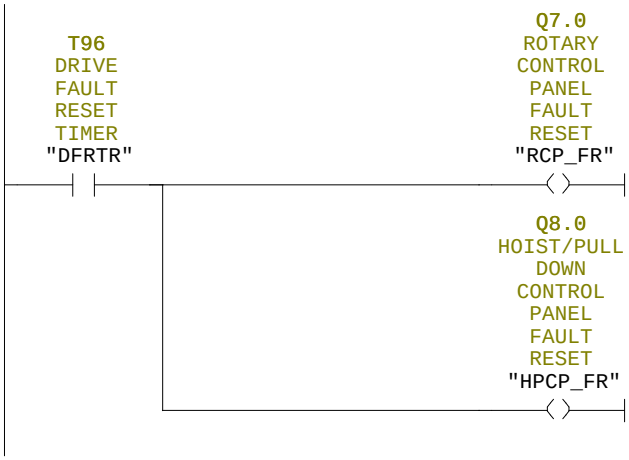
Network: 13 DRIVE FAULT RESET TIMER



Down References
CPCATR FC43:9/SD

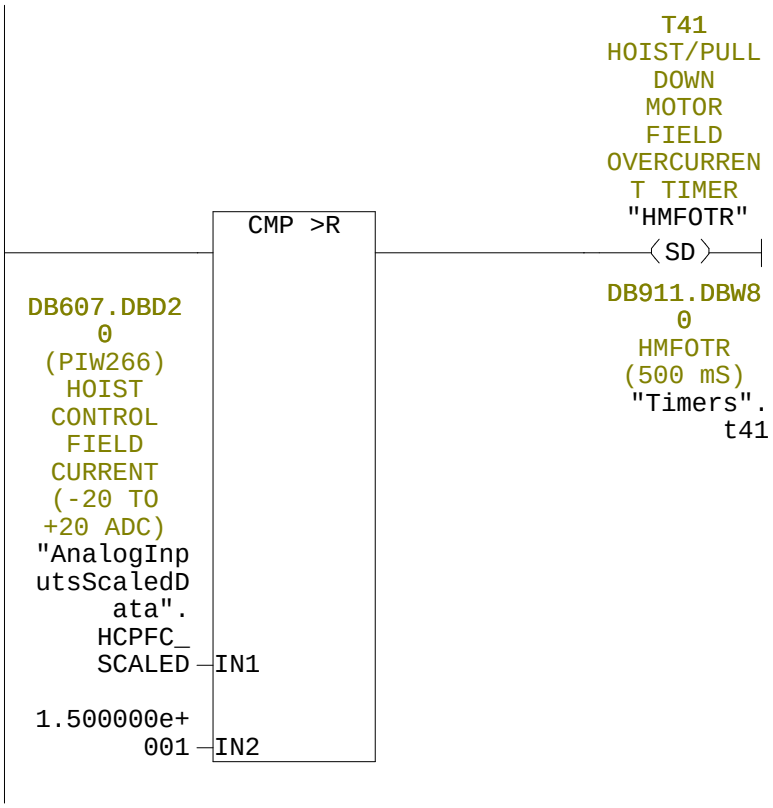
Up References
DFRTR FC43:14/A

Network: 14 DRIVE FAULT RESETS



CBDR612159
Cliffs - Bloom Lake
FC50

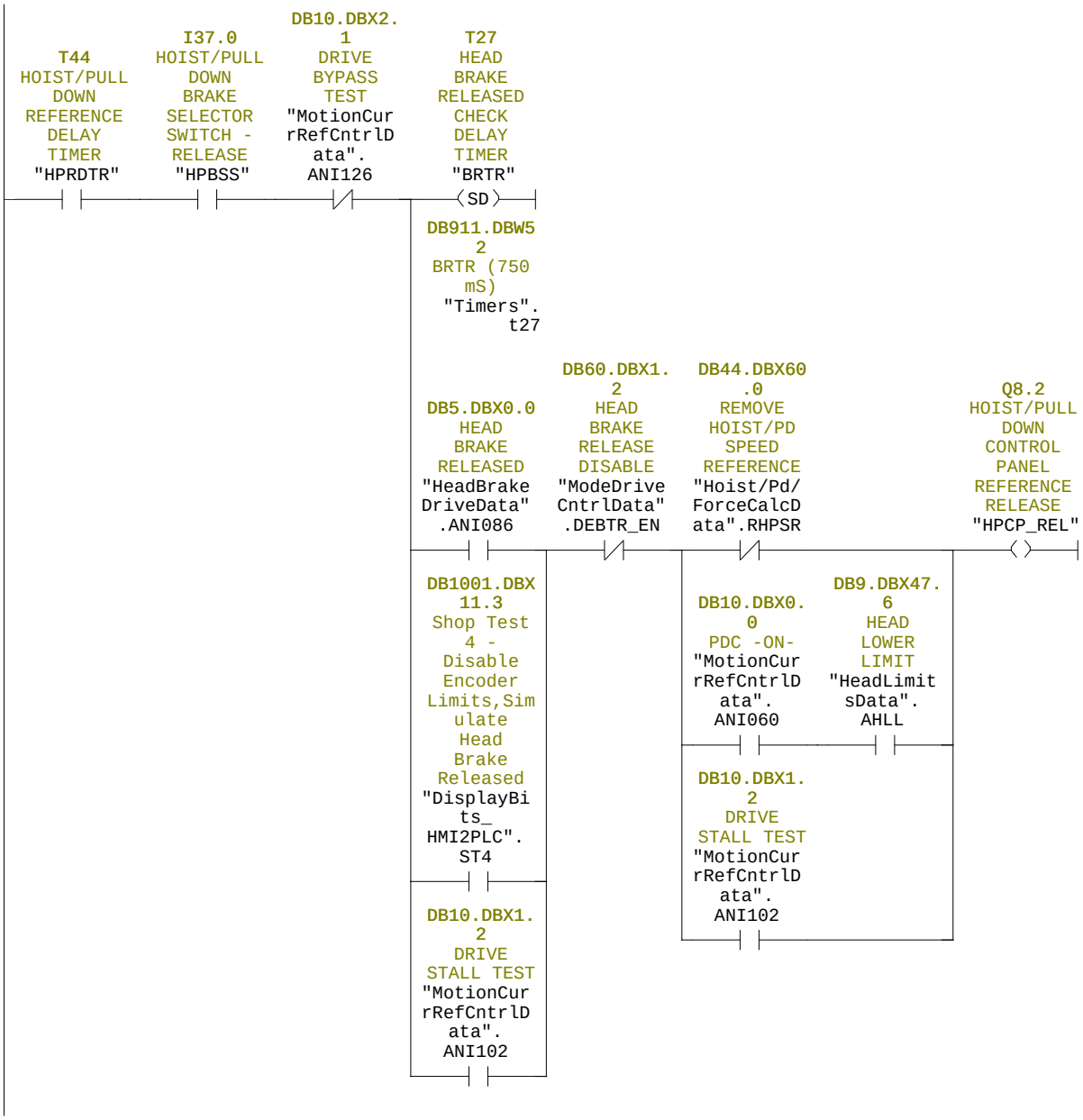
Network: 3 MOTOR FIELD OVER CURRENT
FIELD OVERCURRENT REF SHOULD BE SET TO 120% OF MAX RUNNING AMPS (12.5 A)



Up References
HMFOTR FC50:4/A

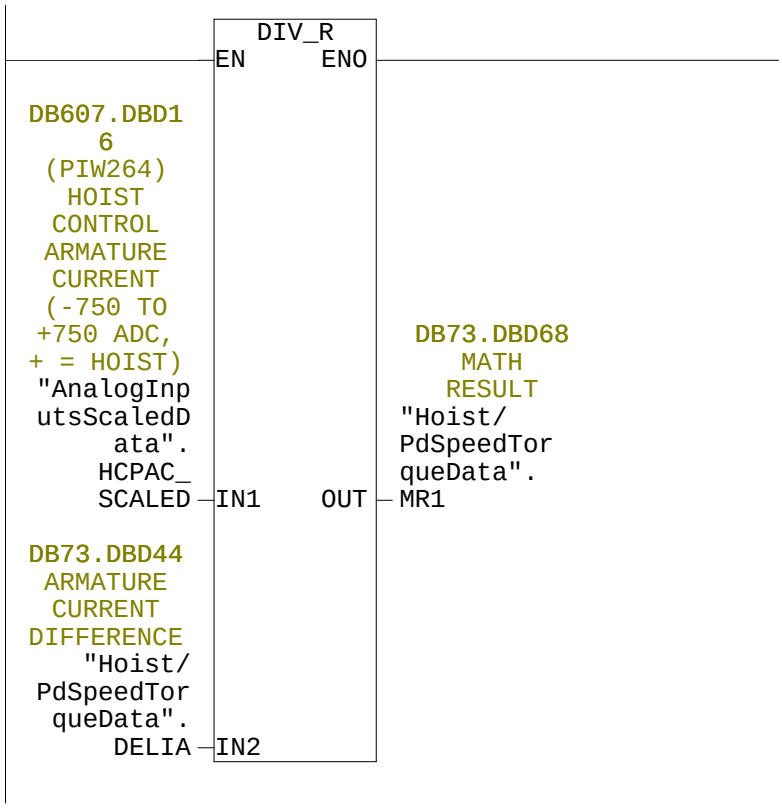
CBDR612159
Cliffs - Bloom Lake
FC50

Network: 10 HEAD BRAKE RELEASED CHECK DELAY TIMER
IF EVERYTHING IS FUNCTIONING PROPERLY, ALLOW THE SPEED REFERENCE OUTPUT TO THE DRIVE. THE HEAD BRAKE SHOULD BE RELEASED AT THIS TIME AND T27 TIMES A SHORT DELAY BEFORE CHECKING TO SEE IF ALL THREE LIMIT SWITCHES AGREE THAT IT ACTUALLY HAS.



Network: 6

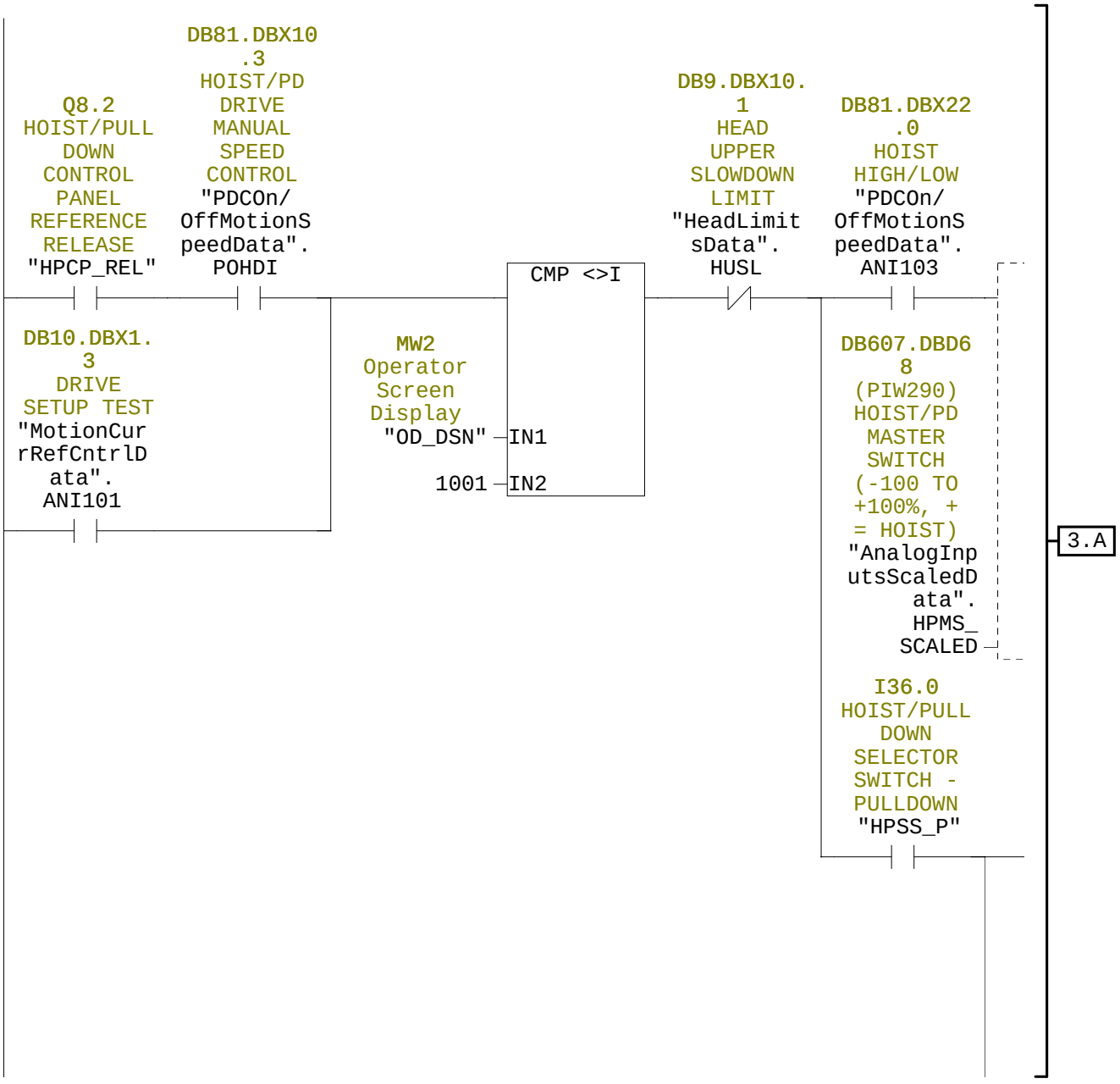
RESULT = IA/DELTA IA



CBDR612159
Cliffs - Bloom Lake
FC52

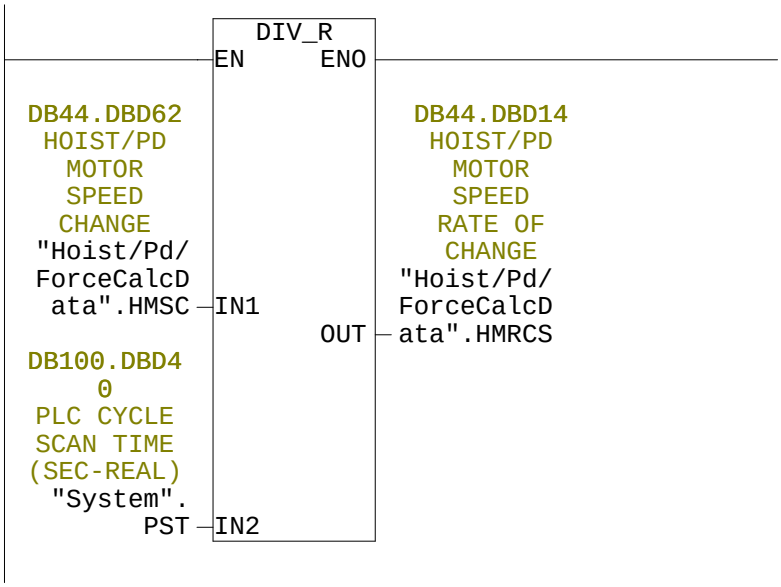
Network: 3 MANUAL HOIST/PD SPEED REFERENCE

IF NOT IN PDC MODE, HMI NOT ON THE CALIBRATION SCREEN AND THE HEAD IS NOT AT UPPER SLOWDOWN LIMIT - ALLOW DIRECT MOVE OF THE MASTER SWITCH INPUT TO THE SPEED REF VALUE IN THE HOIST DIRECTION. APPLY A REDUCTION FACTOR IN THE PULLDOWN DIRECTION

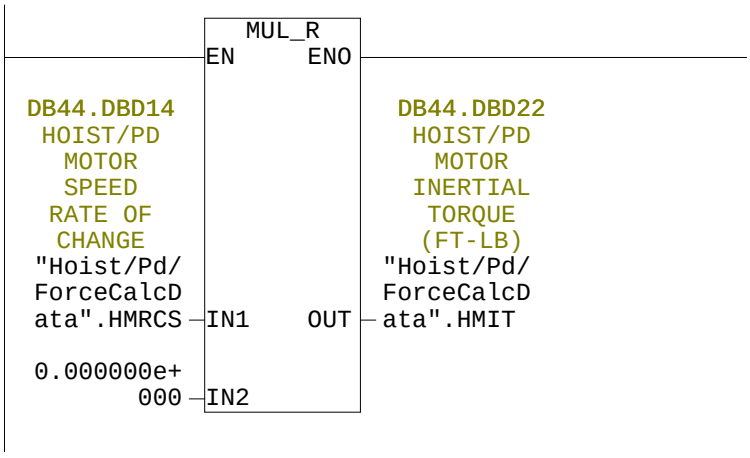


CBDR612159
Cliffs - Bloom Lake
FC53

Network: 4 RATE OF SPEED CHANGE
USING THE PLC SCAN TIME AND THE CHANGE IN SPEED FRON THE LAST SCAN, THE RATE OF CHANGE IS CALCULATED.



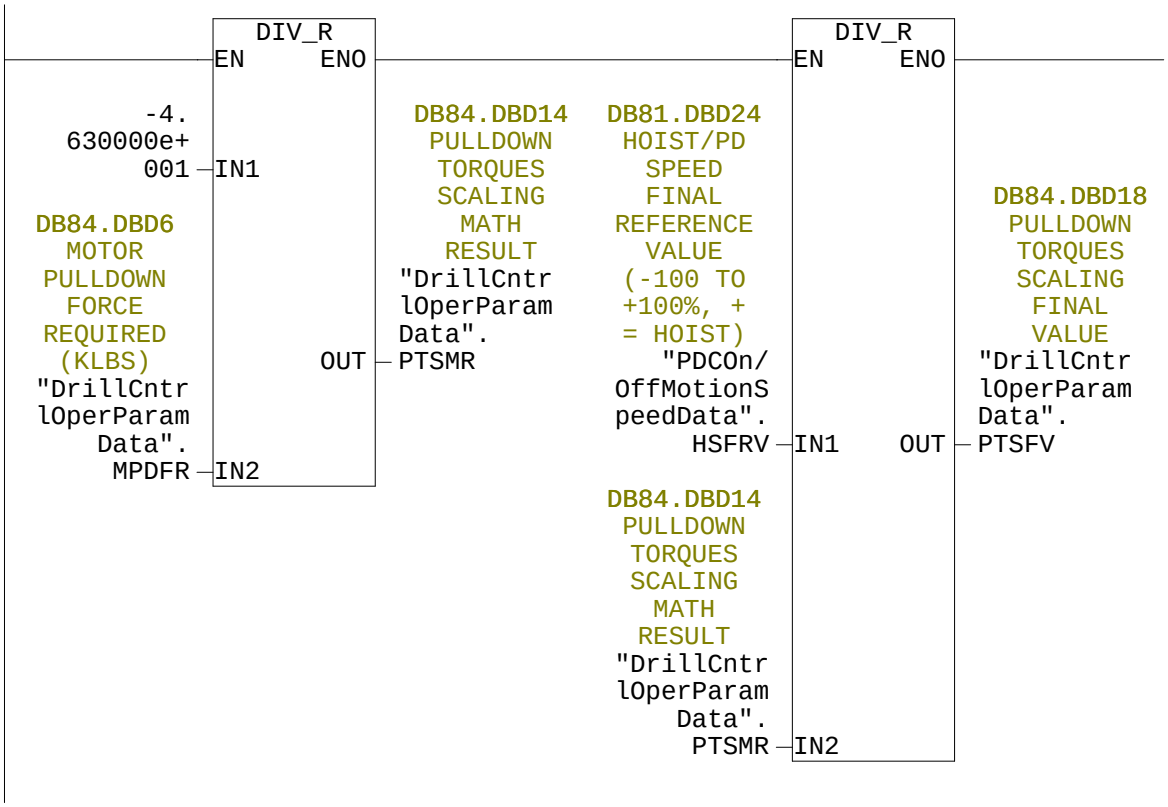
Network: 5 Hoist/Pd motor inertial torque (ft-lb)
INERTIAL TORQUE CONSTANT = (1000)(PI)(J)/30



CBDR612159
Cliffs - Bloom Lake
FC54

Network: 3 PULLDOWN TORQUES SCALING MATH RESULT

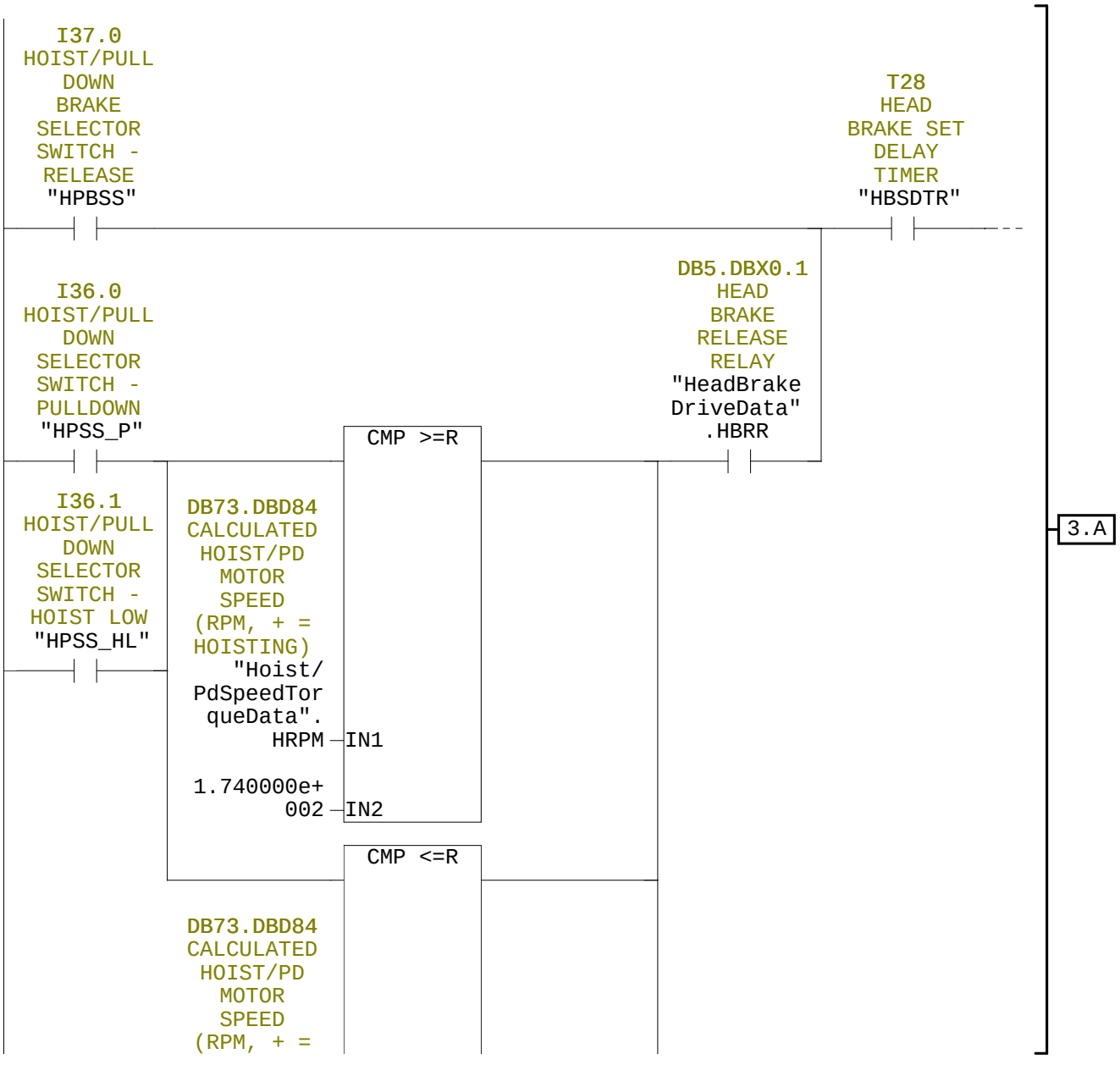
USE THE HOIST/PD SPEED FINAL REF. VALUE TO CONVERT THE MOTOR FORCE REQUIRED INTO A TORQUE VALUE.



CBDR612159
Cliffs - Bloom Lake
FC55

Network: 3 HEAD BRAKE RELEASE RELAY

IF THE MOTOR IS OPERATING AT A SPEED BELOW A DEFINED THRESHOLD (DIFFERENT VALUES FOR HOIST LOW/PULLDOWN AND HOIST HIGH) THE BRAKE WILL SET AS SOON AS THE SS IS TURNED TO THE SET POSITION. IF ABOVE THE THRESHHOLD, IT WILL BE DELAYED FROM SETTING FOR A SHORT TIME TO ALLOW THE MOTOR TO SLOW DOWN AND AVOID EXCESSIVE WEAR.



Down References

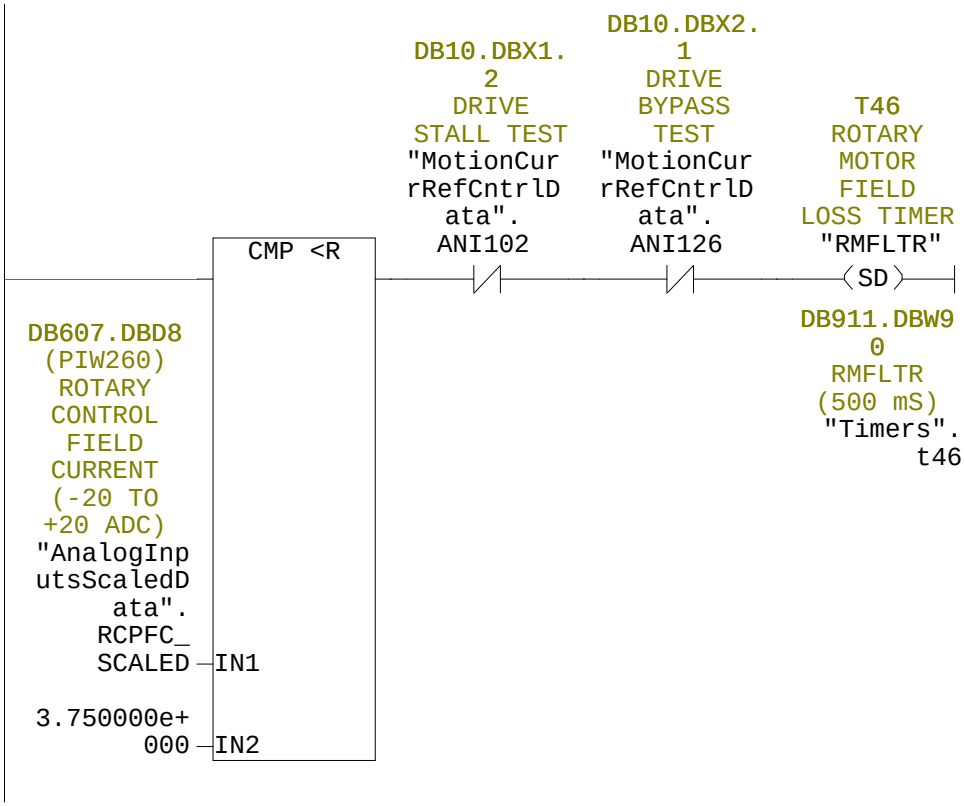
PRST	FC60:1/SD
RMST	FC60:1/SD

Up References

PHTRS	FC46:41/O
PRST	FC60:1/A
RMST	FC60:1/A

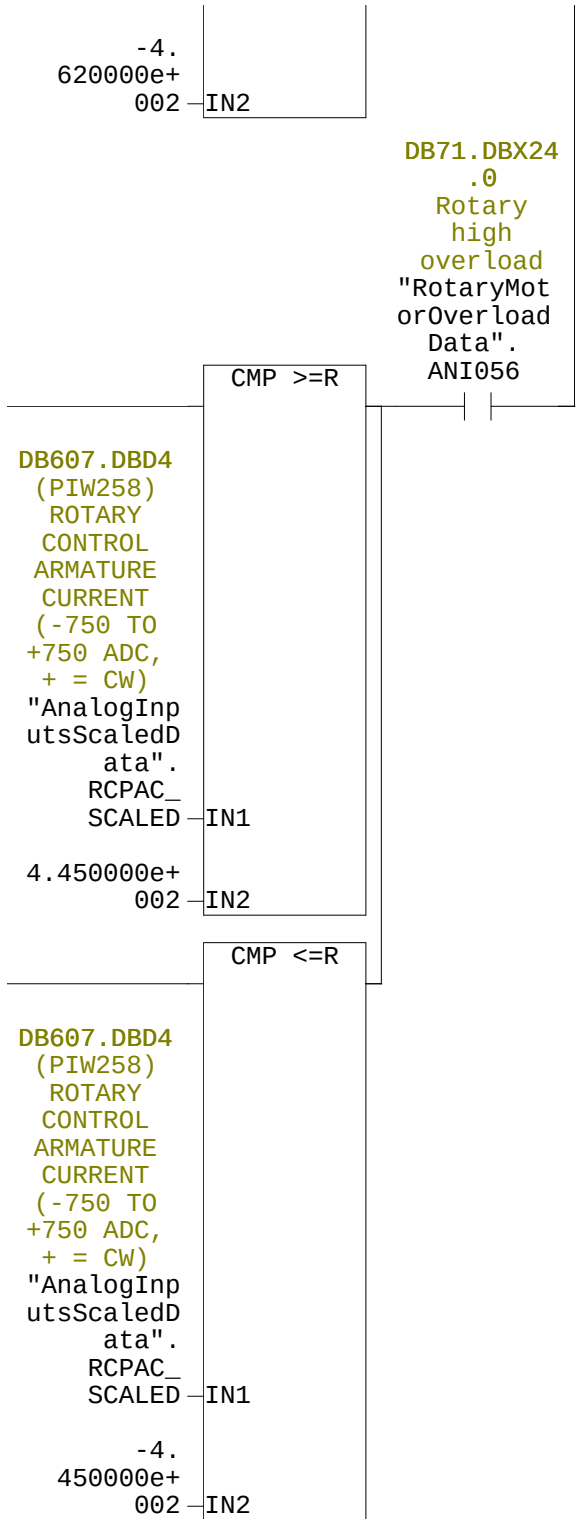
Network: 2 ROTARY MOTOR FIELD LOSS TIMER

FIELD LOSS REF SHOULD BE SET TO 50% OF WEAK FIELD CURRENT



Up References

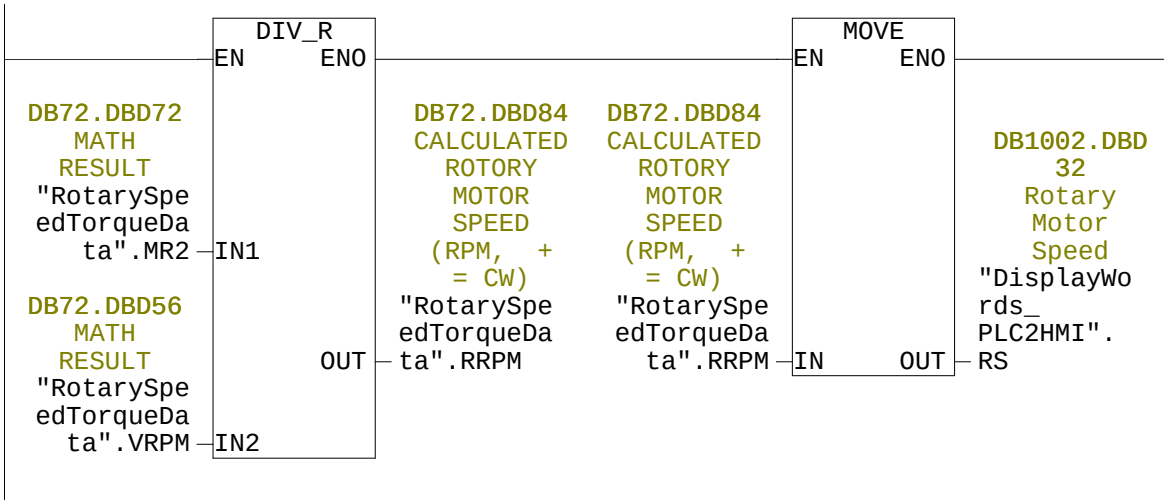
RMFLTR	FC60:4/A



CBDR612159
Cliffs - Bloom Lake
FC61

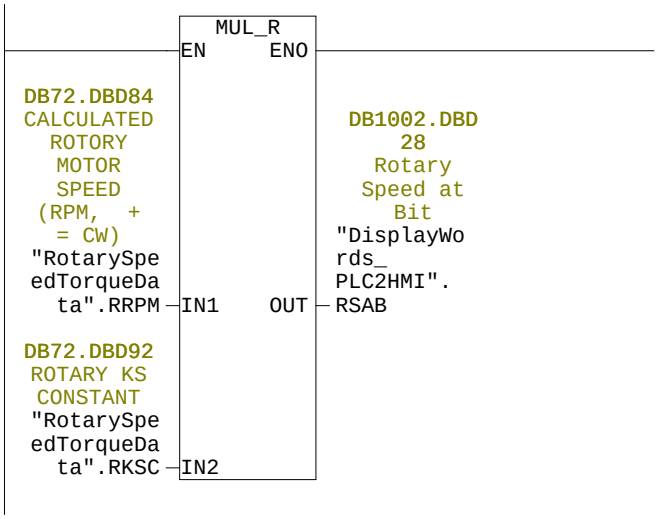
Network: 11

RESULT = MOTOR SPEED IN RPM



Network: 12

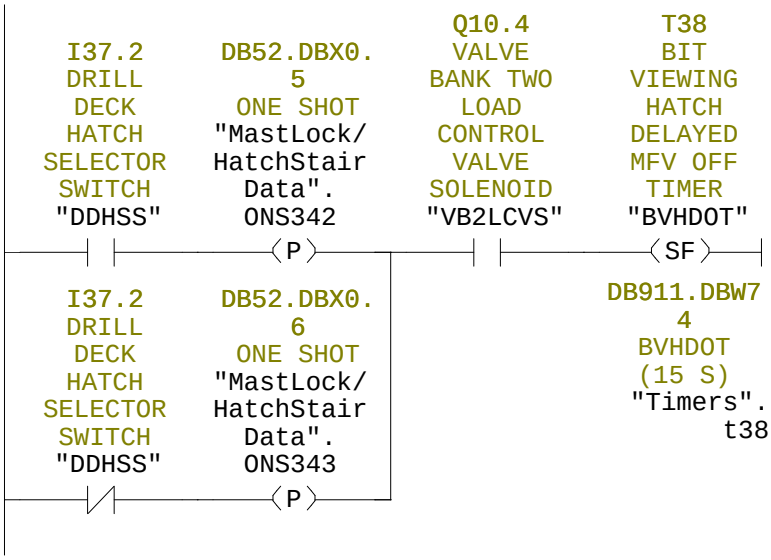
THE OPERATORS DISPLAY SHOWS THE ROTARY SPEED OF THE BIT AS WELL AS THE MOTOR SPEED IN RPM. THE MOTOR SPEED MUST BE MULTIPLIED BY THIS CONSTANT TO GET THE RATORY SPEED AT THE BIT.



CBDR612159
Cliffs - Bloom Lake
FC71

Up References
TWEVS FC153:30/A

Network: 5 BIT VIEWING HATCH DELAYED MFV OFF TIMER

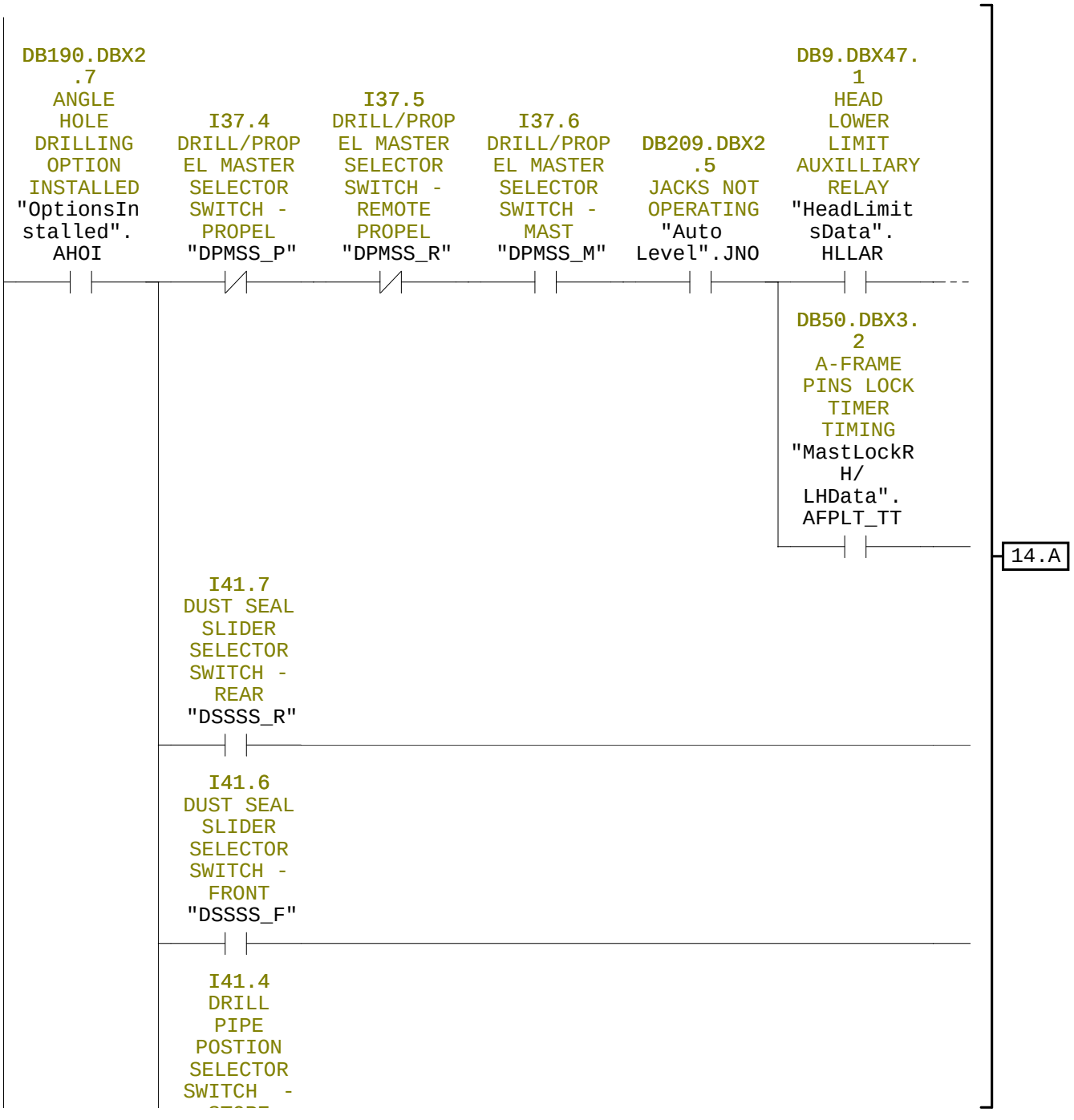


Down References
VB2LCVS FC30:16/= FC36:16/=

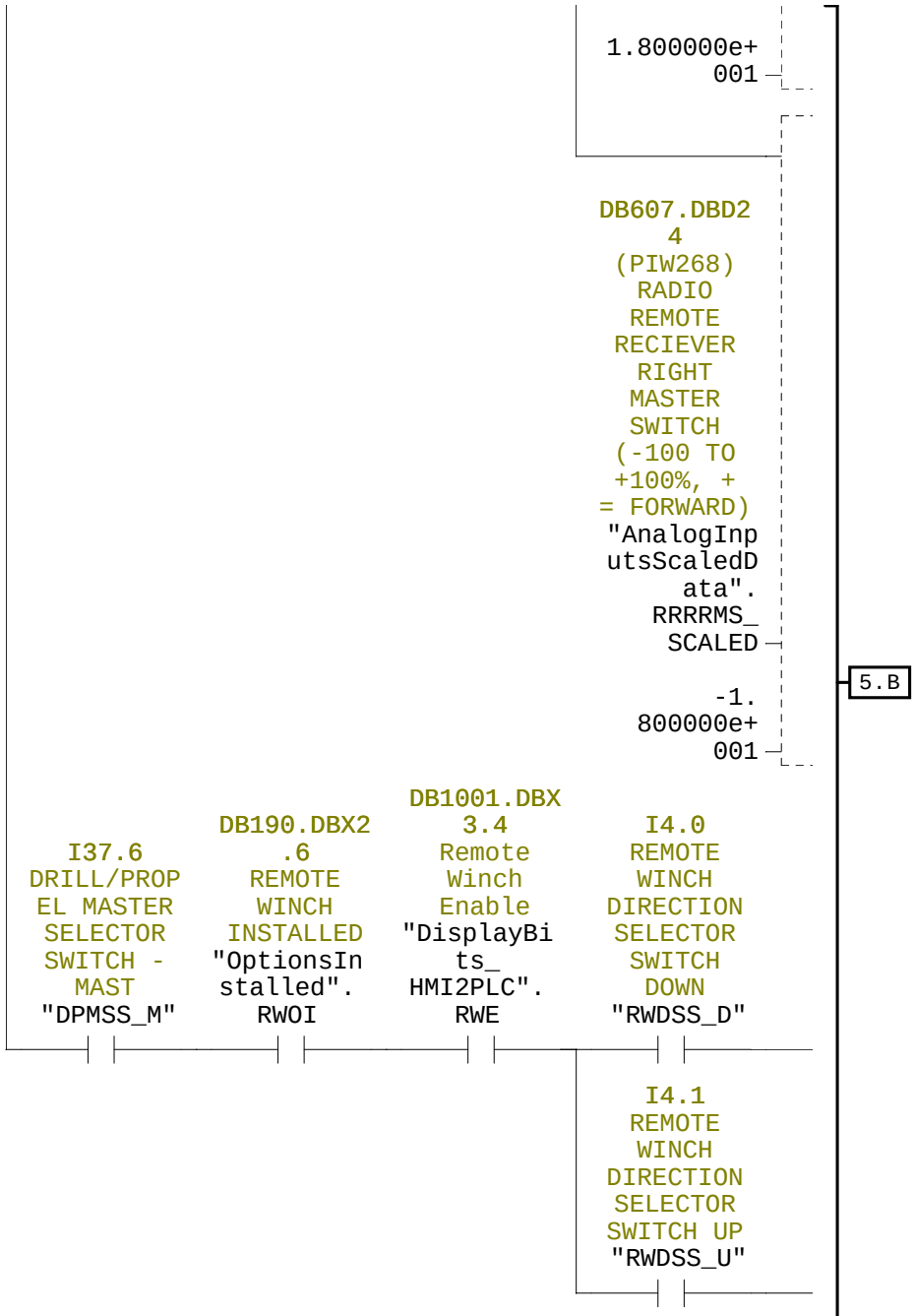
Up References
BVHDOT FC71:12/A

CBDR612159
Cliffs - Bloom Lake
FC71

Network: 14 MAIN FLOW HYDRUALIC VALVE AUXILLIARY



CBDR612159
Cliffs - Bloom Lake
FC72

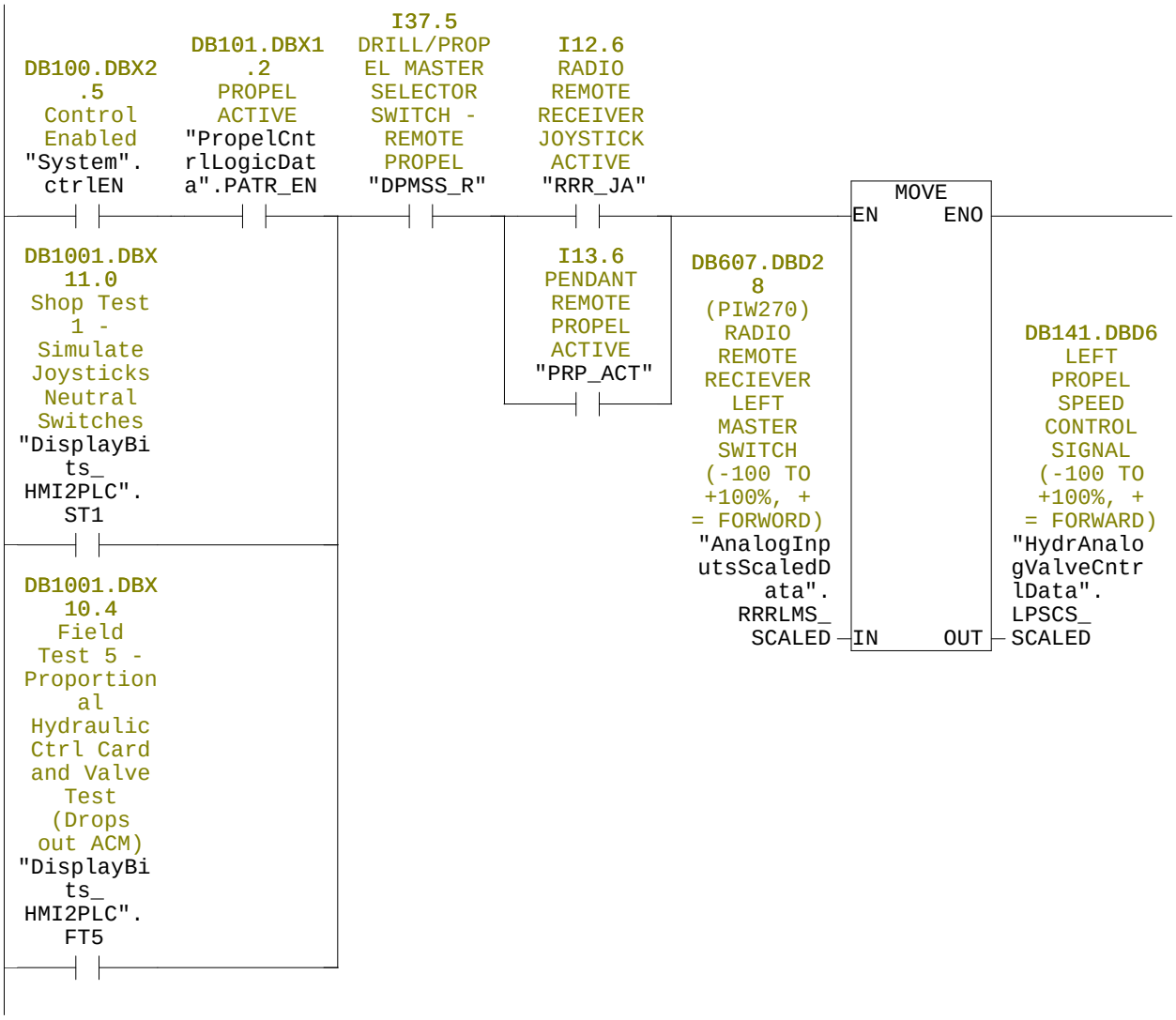


CBDR612159
Cliffs - Bloom Lake
FC72

Network: 15 Remote Propel Left Control Signal

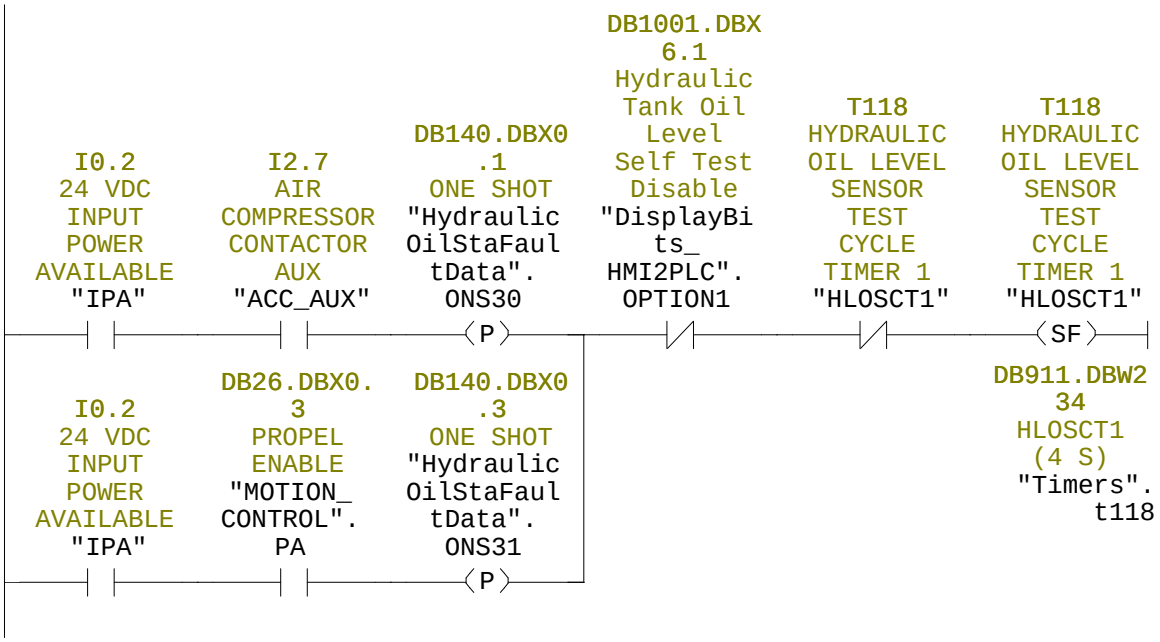
If remote propel movement is allowed, send the scaled signal from the master switch to the address used by the unscale function (FC6)

This network functions the same for both radio remote and pendant remote propel options.



CBDR612159
Cliffs - Bloom Lake
FC74

Network: 1 Hydraulic oil level sensor test cycle timer
WHENEVER THE MAIN MOTOR (AIR COMPRESSOR) IS STARTED OR PROPEL MODE IS SELECTED, T118 TIMES A 4 SEC PERIOD.



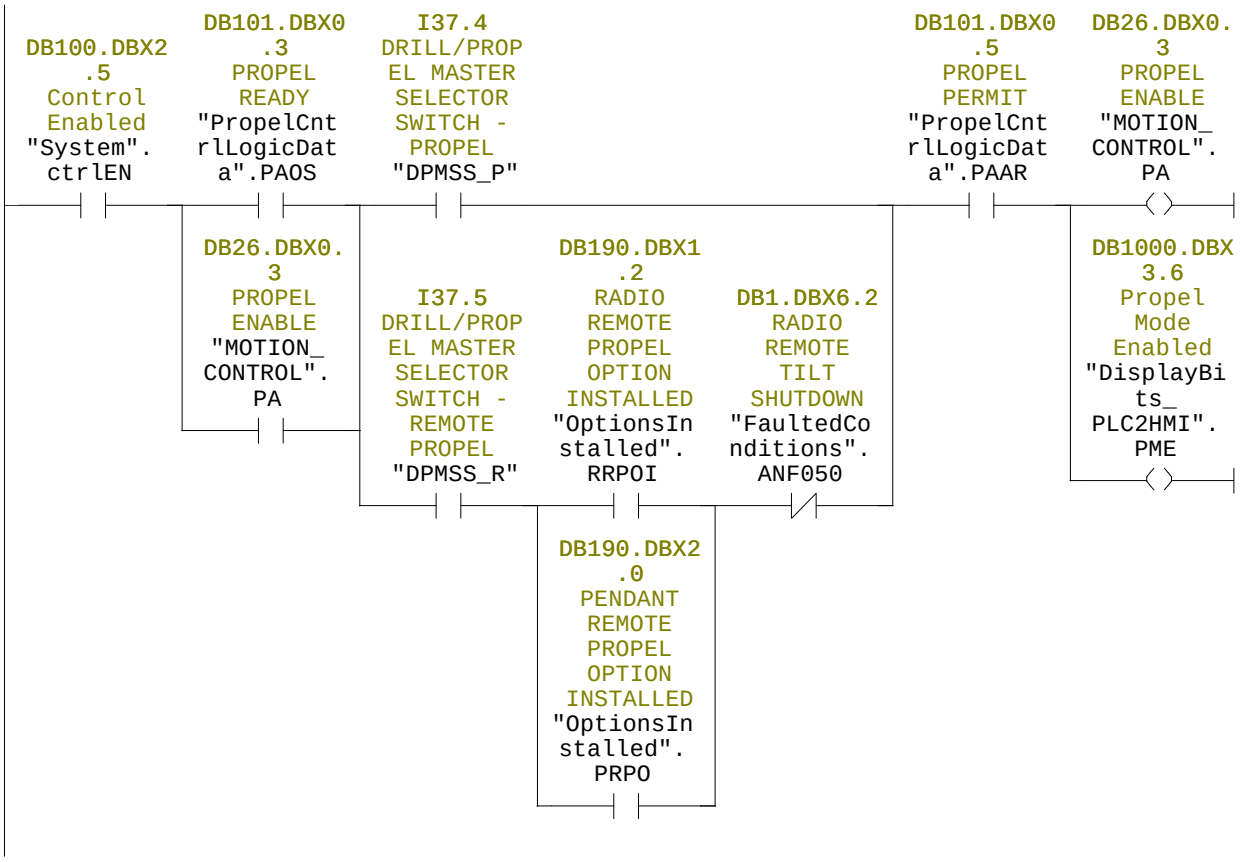
Down References
HLOSCT1 FC74:1/SF

Up References
HLOSCT1 FC74:3/A FC74:2/AN FC74:1/AN

CBDR612159
Cliffs - Bloom Lake
FC75

Network: 3 PROPEL ENABLE

THE READY SIGNAL IS LATCHED IN AS PROPEL ENABLE IF ALL PERMISSIVES ARE OK.



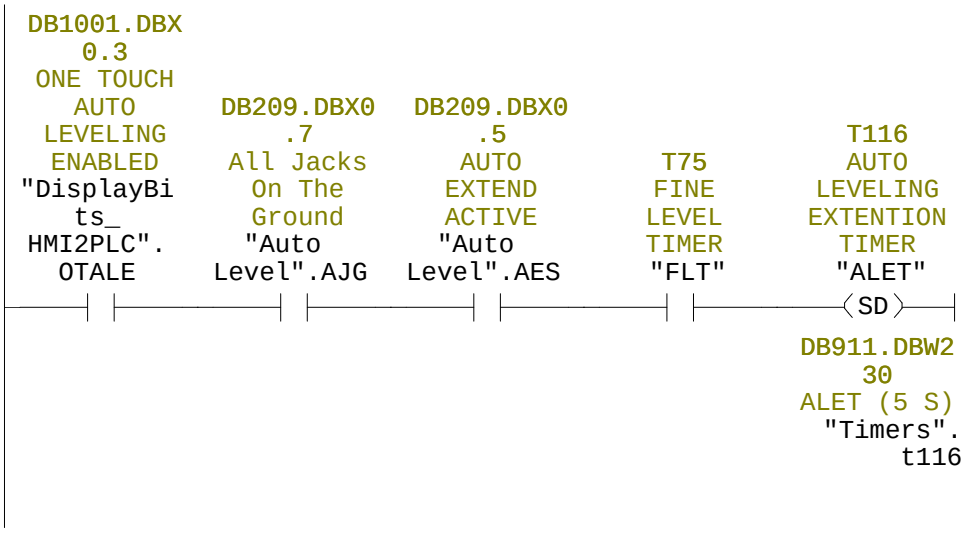
Up References
POWH
PSHTR FC4:4/AN

Network: 14

Down References
ALWAYS_ON OB1:1/S

CBDR612159
Cliffs - Bloom Lake
FC76

Network: 9 ONE TOUCH LEVELING EXTENTION TIMER
IF ONE TOUCH AUTO EXTEND IS ACTIVE, ONCE THE DECK HAS LEVELED T116 TIMES A PERIOD WHERE ALL JACK EXTEND TOGETHER TO LIFT THE DRILL OFF ITS CRAWLERS.



Down References
FLT FC76:27/SD

Up References
ALET FC76:10/AN

CBDR612159
Cliffs - Bloom Lake
FC76

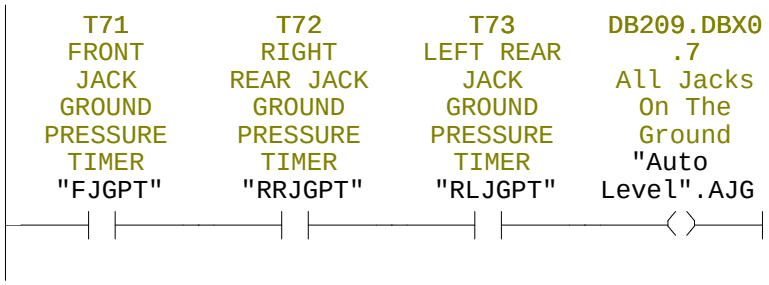
Down References

LJST	FC76:18/SD
RLJGPT	FC76:15/SD
RRJGPT	FC76:14/SD

Up References

LJST	FC76:18/A

Network: 19 All Jacks On The Ground



Down References

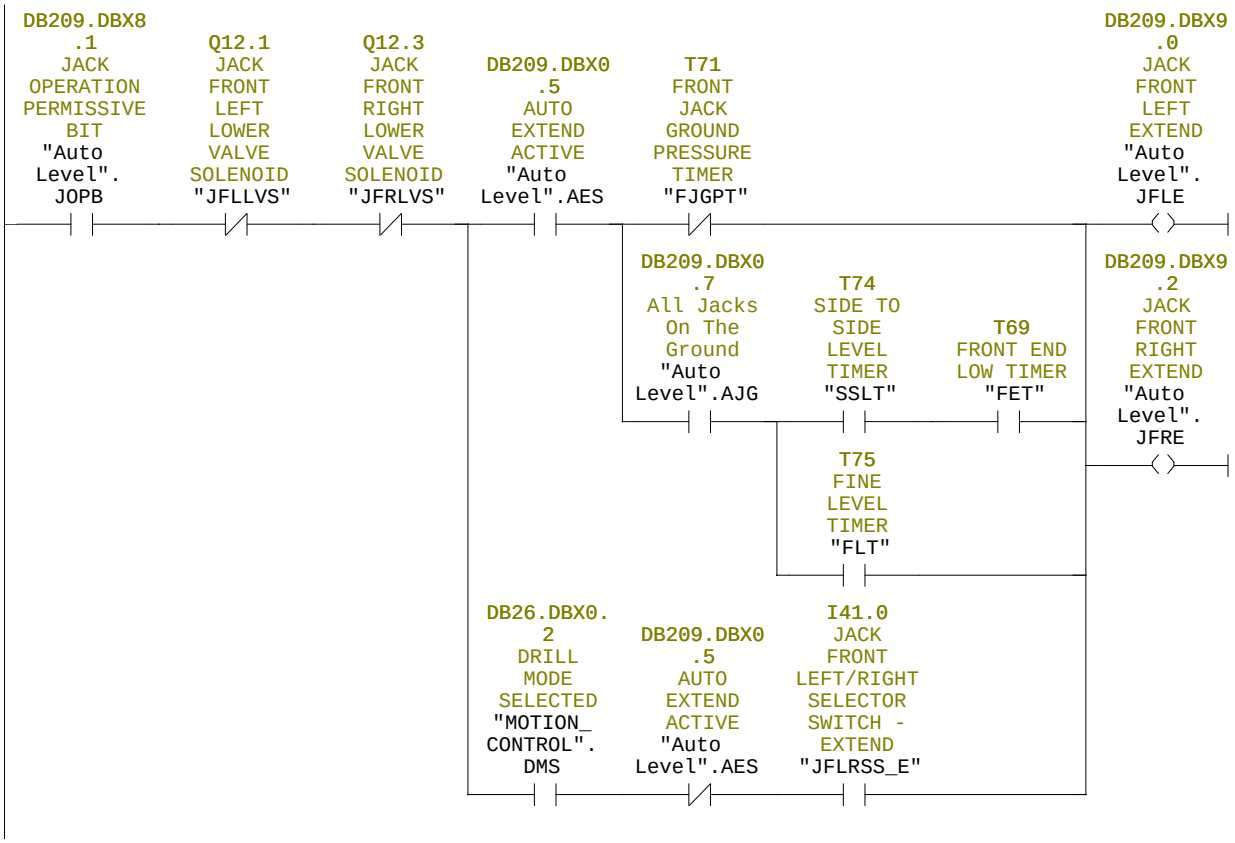
FJGPT	FC76:13/SD
RLJGPT	FC76:15/SD
RRJGPT	FC76:14/SD

Down References
FLT FC76:27/SD

Up References
FLT FC76:30/O FC76:29/O FC76:28/O FC76:27/A FC76:9/A

Network: 28 FRONT JACKS EXTEND

PERMISSIVES TO ALLOW EXTENDING THE LEVEL JACKS IN AUTO OR MANUAL MODE.



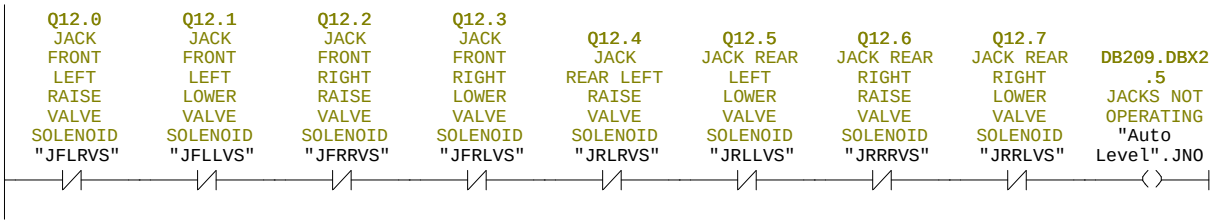
Down References
FET FC76:23/SD
FJGPT FC76:13/SD
FLT FC76:27/SD
JFLLVS FC76:39/R FC76:38/S
JFRLVS FC76:39/R FC76:38/S
SSLT FC76:26/SD

CBDR612159
Cliffs - Bloom Lake
FC76

Down References
ALWAYS_ON OB1:1/S

Network: 40 Jacks Not Operating

Other logic requires that the jacks not be operating. This network sets a bit for use elsewhere.



Down References

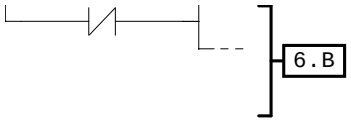
JFLLVS	FC76:39/R	FC76:38/S
JFLRVS	FC76:39/R	FC76:38/S
JFRLVS	FC76:39/R	FC76:38/S
JFRRVS	FC76:39/R	FC76:38/S
JRLLVS	FC76:39/R	FC76:38/S
JRLRVS	FC76:39/R	FC76:38/S
JRRLVS	FC76:39/R	FC76:38/S
JRRRVS	FC76:39/R	FC76:38/S

Network: 41

Down References

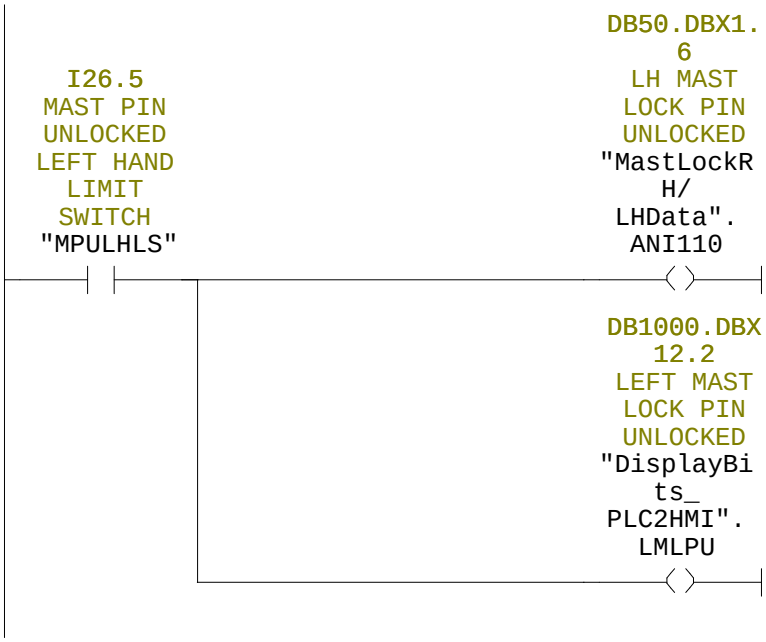
ALWAYS_ON	OB1:1/S

CBDR612159
Cliffs - Bloom Lake
FC77

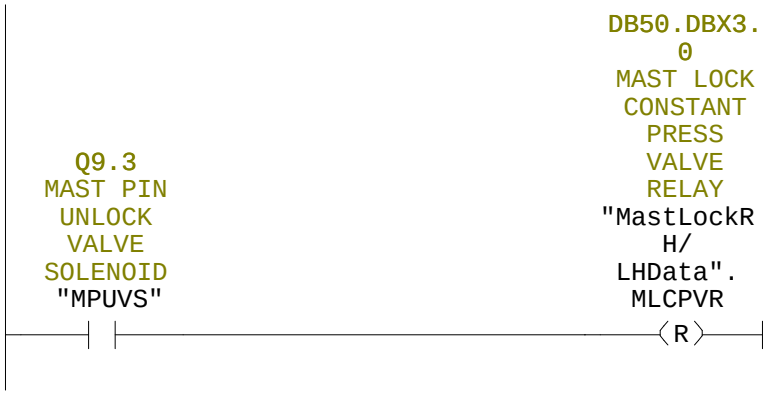


CBDR612159
Cliffs - Bloom Lake
FC77

Network: 19 LH MAST LOCK PIN UNLOCKED

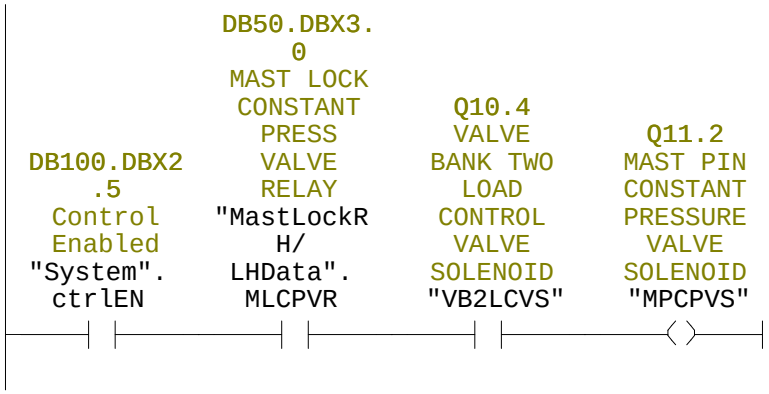


Network: 32 MAST LOCK CONSTANT PRESS VALVE RELAY



Down References
MPUVS FC77:4/=

Network: 33 Mast lock constant pressure valve

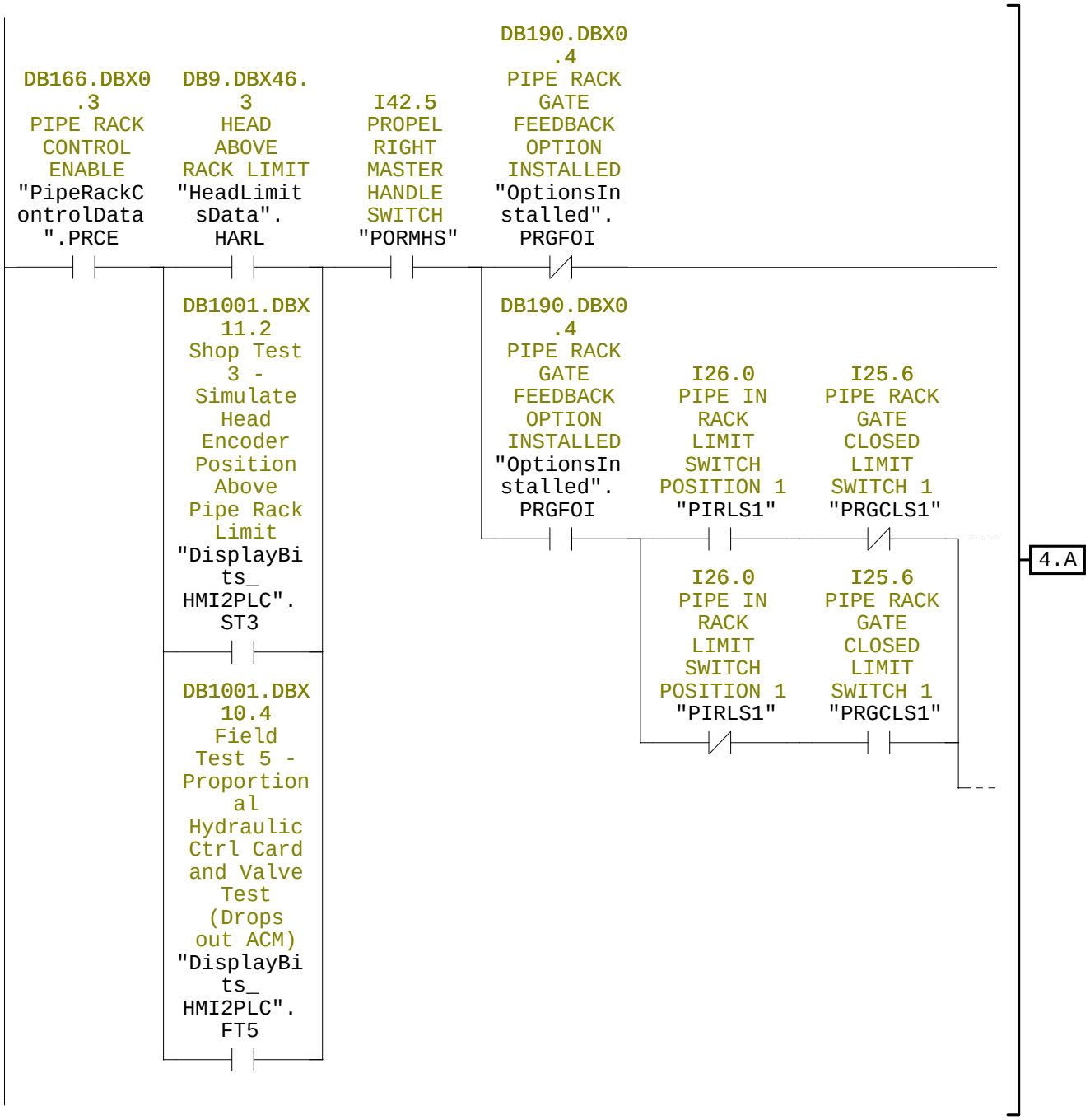


Down References
VB2LCVS FC30:16/= FC36:16/=

Up References
MPCPVS

CBDR612159
Cliffs - Bloom Lake
FC78

Network: 4 PIPE RACK FLOW ENABLE



CBDR612159
Cliffs - Bloom Lake
FC79

Network: 4

Down References
ALWAYS_ON OB1:1/S

Down References
LDVS FC81:13/=
VB2LCVS FC30:16/= FC36:16/=

Up References
LDVDDT FC81:13/A
PDT FC81:16/O

Network: 13 LUBE DIRECTION VALVE SOLENOID

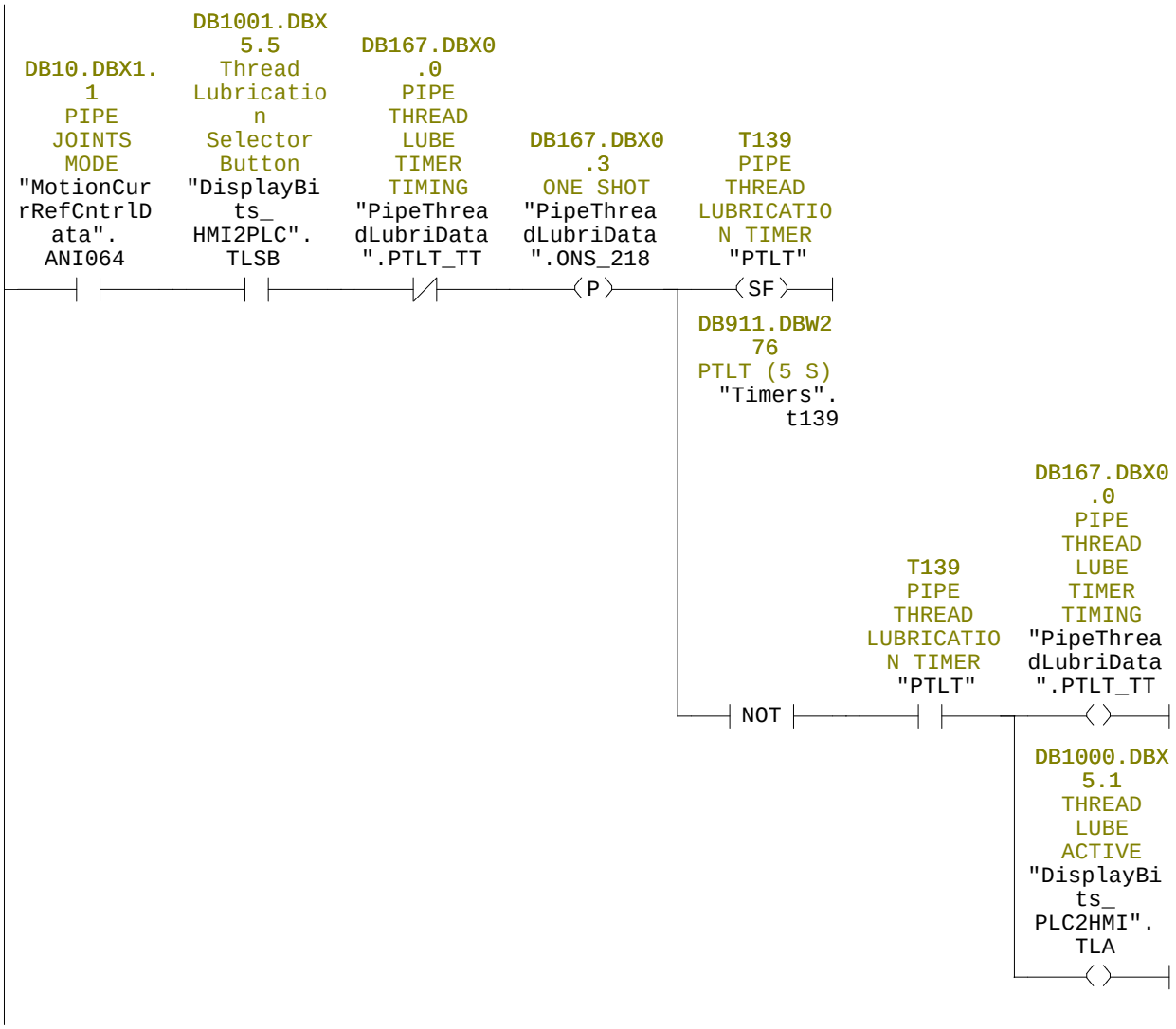
WHEN THE DIRECTION VALVE IS ENERGIZED, LUBE WILL BE SENT TO BOTH THE HEAD AND THE CRAWLER/CHASSIS LUBE POINTS. WHEN OFF, ONLY THE CRAWLER/CHASSIS IS LUBED.

Down References
LDVDDT FC81:12/SF

Up References
LDVS FC81:12/A

CBDR612159
Cliffs - Bloom Lake
FC82

Network: 1 Pipe Thread Lubrication Timer
IF IN PIPE JOINTS MODE, THE THREAD LUBRICATION SOLENOID WILL BE ENERGIZED FOR 5 SEC EACH TIME THE LUBE BUTTON IS PRESSED ON THE HMI MAINTENANCE SCREEN, OR FOR AS LONG AS IT IS PRESSED AND HELD.

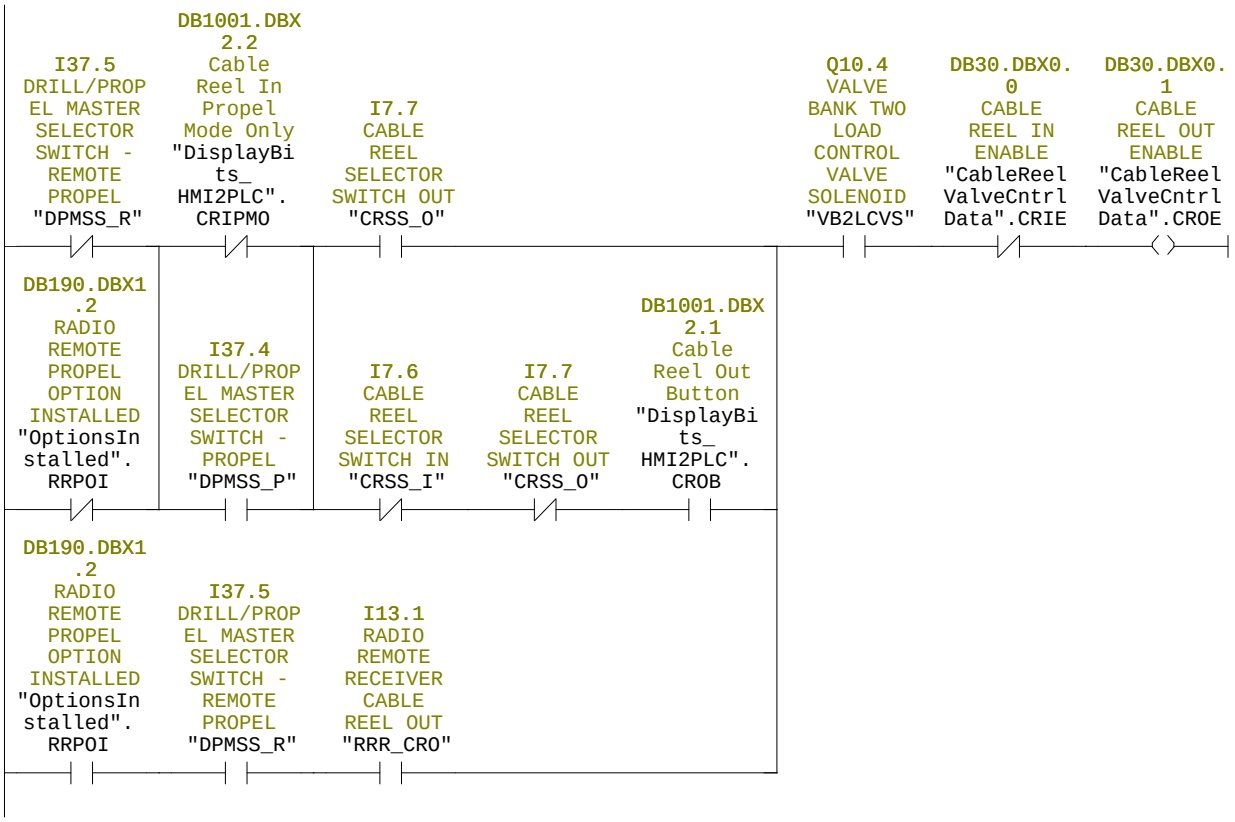


Down References

PTLT	FC82:1/SF

CBDR612159
Cliffs - Bloom Lake
FC90

Network: 2 CABLE REEL OUT ENABLE



Down References
VB2LCVS FC30:16/= FC36:16/=

CBDR612159
Cliffs - Bloom Lake
FC91

Q11.6
CABLE
REEL WIND
VALVE
SOLENOID
"CRWVS"

4.A