Technical Manual

OPERATOR INTERFACE

Overview

There are three main components to the 39HR operator interface. The primary component is the set of buttons and switches on the Operator's Chair in the cab. These are the main controls used in the operation of the drill. The second set of controls exists in the Console, which is the cabinet housing the PLC processor located in the cab. This cabinet includes less frequently accessed controls as well as the control and feedback panel from the diesel engine. The third component of the operator interface system is the Operator Display, mounted on the Operator's Chair. This displays machine data, indicators, and alarms. Machine setup parameters and user options are also entered through the display. Refer to the separate instruction that discusses the display in depth. *Note that there may also be a Remote Propel unit if that option was purchased for the drill*.

Most of the controls mentioned above feed directly into the PLC system, described in its own section. Others are "direct drive", meaning that the controls are directly tied to their outputs and not modified by the computer control system.

The rest of this section discusses to the operation of each of the primary controls. The schematic/PLC symbol code is specified in the heading for each control. *Note that there may also be other controls not discussed here. These may be part of certain enhancements, special options packages, or customer requests*.

Operator Chair Controls

In this section, each of the primary controls on the operator's chair are discussed. See Figure 3. The masterswitches are listed first, and then each of the selector switches and pushbuttons in the order in which they occur on the pods.

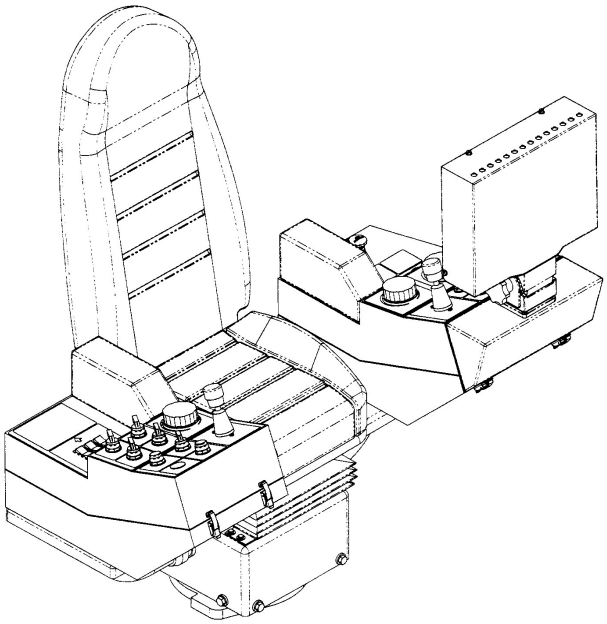


Figure 3 – Operator's Chair

- Power must be supplied to the control system.
- The power-up timer must be done. This timer, integrated with the PLC, inhibits operation for a set period of time while the control system stabilizes. Refer to output PUTR.
- The diesel engine must be up to operating speed. This is defined as an input to the control system, when the diesel is above a preset value (initially set in the engine to 1650 rpm).

Machine Setup and Calibration

Overview

To allow the drill to function properly, the head first needs to be properly calibrated. Head position is sensed by an encoder mounted on the mast. This encoder provides a "count" feedback to the control system, which tells the head position. This is transmitted with the same Profibus communication protocol that all remote I/O stations use on the 39HR. When the drill is first setup, it is necessary to tell the control system where the top of the mast is, as well as the required limits. These procedures should be followed whenever the drill is commissioned, when the settings are lost due to hardware or software changes, or whenever drilling conditions require changes. It is also suggested that the drill be recalibrated on regular basis, due to possible slipping of the drive ropes.

Head Calibration

The following procedure outlines the calibration routine for the head encoder. This is normally performed at the initial machine erection and should not need to be performed again unless the encoder fails or the PLC/Display program data are lost.

1. Go to the calibration screen on the operator display, as shown in Figure 6. Note that a password is required to gain access to this screen.
2. Move the head to the top most part of its range at the mechanical stop, using the hoist masterswitch. It is required that the top mechanical stop be calibrated first. While the Calibration screen is active, reference is reduced to 35% of the input and all limits are disabled. While not absolutely necessary, any head drift while the button is being pressed in the next step will cause the calibration to be invalidated.
3. Press the "Top Calibrate" button on the display. The encoder calibrate value below the button will be set to zero, as will the current count at the bottom of the Drilling Data window.
4. While moving the head down, make sure the Head Encoder Count starts incrementing from zero immediately. If the head makes significant movement with no change in count, it is likely that the calibration did not take. Repeat from step one, making sure the brake is set.
5. Repeat the process at the lower mechanical stop and press the "Bottom Calibrate". Its value will change to the current encoder count.

During operation of the drill, some mechanical slippage may occur, causing the head to be out of calibration. This can be checked by going to the calibration screen and moving the head to the lower stop limit. If the Head Encoder Count display is significantly different than the Bottom Calibrated point, recalibration is required. Additionally, if bringing the head to the top mechanical stop results in a Head

- If the Jack Retract Switch option was purchased for the drill, all the jacks must be fully retracted as well.

It should be noted that there is a brief delay after all the conditions are met and when the brake's state actually changes. This is to allow the hydraulic system to stabilize. Refer to the operator display for the actual state of the valve output. (The display only gives the state of the control signal, there is no standard feedback from the brake itself.)

Winch

The winch is used to load pipes, bits, and other equipment on to or off of the main frame. The winch is controlled with the same joystick used to control the left propel track. This joystick is located in the left pod of the operator's chair. The winch can only be moved when the drill is in MAST mode, as set by switch on the operator's chair.

In order for the winch to be raised or lowered with 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 to MAST mode.
- The pipe arm must be fully lowered.
- The drill must be at least in Coarse Level (±2°) as shown on the Leveling screen of the operator display.
- No other major hydraulic function (jacks, wrenches, pipe arm, etc.) can be operating

Also, the winch is equipped with a safety device to stop operation at maximum height. When the winch trips the Winch Raise Stop Switch (WRSS), no further upward control is allowed.

Options

Air Compressor Variable Volume Control (Option)

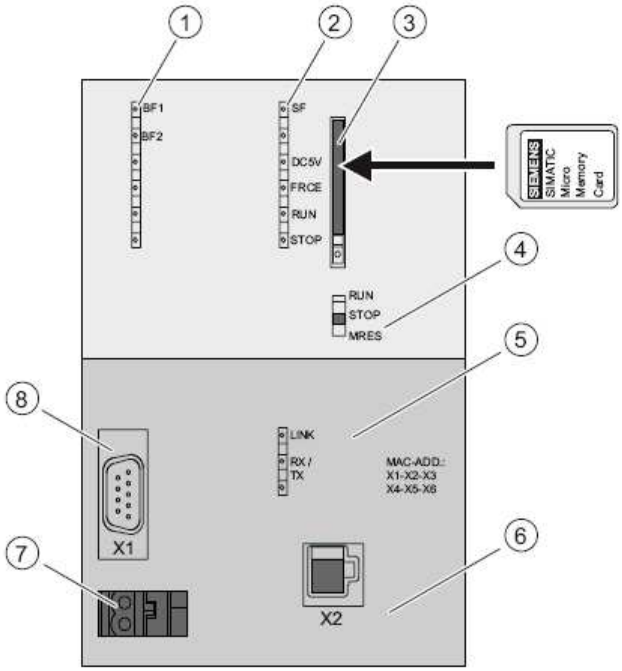
The variable volume controls for the air compressor are only included on machines that have this option. This allows the volume of air put out by the compressor to b reduced through the use of three reduction valves. By combining these valves, the initial outputs can be 100% (no reduction), 92% (one valve enabled), 78% (two valves enabled), or 68% (three valves enabled). Note that the actual reductions on your drill may be different due to air compressor design. Refer to the mechanical documentation for more information on the settings.

The variable volume setting is controlled through a button on the operator display's Status Screen in the "Compressor Volume" window, with a valve graphic on it. Pressing this button multiple times will cycle through each of the four settings. In each case, the current setting is displayed in a text box above the button. The volume is also represented graphically with a tank which shows a varying volume level.

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.

Processor

The processor is located in the main rack in the operator's cab. It is the first card in the rack. The processor is where the application program is stored and run. All other nodes, cards, and devices are controlled by the processor.



Number	Description
①	Bus error indicators
②	Status and error displays
③	Slot for the SIMATIC Micro Memory Card incl. the ejector
④	Mode selector switch
⑤	Status display of 2nd interface (X2)
⑥	2. Interface X2 (PN)
⑦	Power supply connection
⑧	1. Interface X1 (MPI/DP)

Figure 14 – PLC Processor

The processor has a mode selector switch on the front, which controls program operation. When it is set to RUN, the program is allowed to execute, provided there are no faults that prevent execution. STOP mode halts execution of the program. In this case, the drill will not operate. MRES is used to reset the memory in the processor. See below for information on this operation.

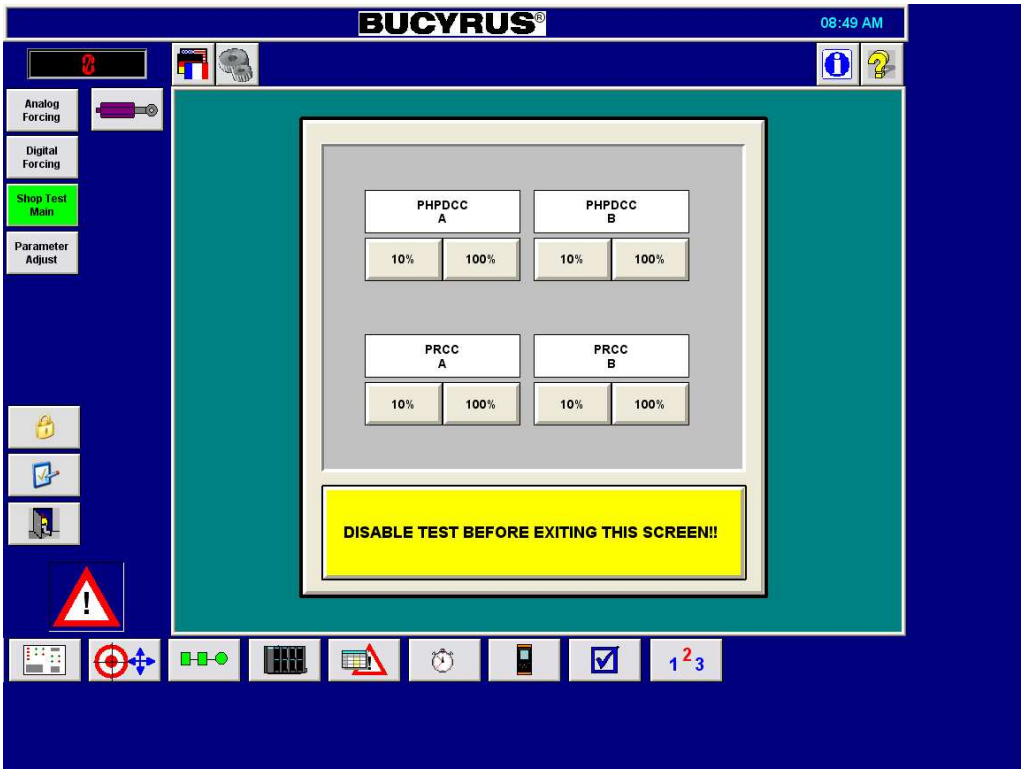


Figure 22 - Hydraulic Card Setup Screen

9. For each card, select 10% for valve A by pressing the corresponding button on the operator screen.

10. Using a small screwdriver, adjust the "I Min A" setting to get the standard output current as shown on the C-Sheet for the drill (initially set to 150mA). These adjustments are located on the front of the card. See Figure 21.

11. For each card, select 100% for valve A by pressing the corresponding button on the operator screen.

12. Using a small screwdriver, adjust the "I Max A" setting to get the standard output current as shown on the C-Sheet for the drill (initially set to 380mA). These adjustments are located on the front of the card. See Figure 21.

13. For each card, select 10% for valve B by pressing the corresponding button on the operator screen.

14. Using a small screwdriver, adjust the "I Min B" setting to get the standard output current as shown on the C-Sheet for the drill (initially set to 150mA). These adjustments are located on the front of the card. See Figure 21.

15. For each card, select 100% for valve B by pressing the corresponding button on the operator screen.

Fault	Message	Description / Effect	Recommended Action	Warning Only	Diesel Shut-down	Operator Reset Required	Master Switch Neutral Required to Reset
CDA007	Profibus Node 4 (Power Module Rack) Fault	Communication has been lost to the indicated remote I/O node or an error has occurred in that node. The emergency shutdown sequence will occur.	1. Use the PLC Diagnostics screen to get more information (Main Menu – PLC Menu – PLC Status) 2. Verify power to the indicated rack and cards in the rack as per the schematic. 3. Verify Profibus cable is properly connected to the display and to the previous node. 4. Verify the termination resistor switch on the Profibus cable connector is set in accordance with the schematics on ALL nodes. 5. Check the LED's on the communication card for more information on possible problems.		X	X	X

Fault	Message	Description / Effect	Recommended Action	Warning Only	Diesel Shut-down	Operator Reset Required	Master Switch Neutral Required to Reset
CDA030	Boarding Stairs Down	The operator is trying to release the propel brakes or operate the leveling jacks with the boarding stairs down. The attempted operation will not occur. While this particular fault prevents motion, it is not a latched fault. As soon as the stair are raised, the desired operation is free to occur.	1. Raise all boarding stairs before attempting to propel or operate the jacks.				

Fault	Message	Description / Effect	Recommended Action	Warning Only	Diesel Shut-down	Operator Reset Required	Master Switch Neutral Required to Reset
CDA056	Pulldown Pressure Transducer (PPTD) Error	The control system is reading a value for the indicated signal that is outside the expected range.	1. Verify the wiring to between the PLC input card and the indicated device. This error usually indicates that the device has its polarity reversed. 2. Verify the operation of the indicated device. 3. Check for other PLC communication or operation errors, especially those that may be indicated on the operator display.	X			
CDA057	Rotary Speed Feedback (RSF) Error	The control system is reading a value for the indicated signal that is outside the expected range.	1. Verify the wiring to between the PLC input card and the indicated device. This error usually indicates that the device has its polarity reversed. 2. Verify the operation of the indicated device. 3. Check for other PLC communication or operation errors, especially those that may be indicated on the operator display.	X			

Head Encoder LED's

The new style head encoder (effective Lots 8 and future) contains diagnostic LED's. This same encoder is completely compatible with the encoder used on Lots 6 and 7 and can be used as a replacement.

Figure 27 - Head Encoder LED's

POWER – This indicator is always on only if 24VDC is properly supplied to the encoder.
ERROR – This indicator is on if the encoder is experiencing some type of internal error. Cycle power to the drill. If the error does not clear, open the encoder up and check its DIP switch settings as described earlier in this manual. If the error still does not clear, replace the unit.
BUS – This indicator is always on only if the Profibus connection to the encoder is properly active.

Decimal	Hexadecimal	Description
33072	8130	User submodule incorrect/not found
33073	8131	Communication problem
33074	8132	Operating mode: RUN/STOP (STOP: entering state, RUN: leaving state)
33075	8133	Time monitoring responded (watchdog)
33076	8134	Internal module power failure
33077	8135	BATTF: battery exhausted
33078	8136	Total backup failed
33079	8137	Reserved
33088	8140	Expansion rack failed
33089	8141	Processor failure
33090	8142	EPROM error
33091	8143	RAM error
33092	8144	ADC/DAC error
33093	8145	Fuse blown
33094	8146	Hardware interrupt lost
33095	8147	Reserved
33104	8150	Configuration/parameter assignment error
33105	8151	Common mode error
33106	8152	Short circuit to phase
33107	8153	Short circuit to ground
33108	8154	Wire break
33109	8155	Reference channel error
33110	8156	Below measuring range
33111	8157	Above measuring range
33120	8160	Configuration/parameter assignment error
33121	8161	Common mode error
33122	8162	Short circuit to phase
33123	8163	Short circuit to ground
33124	8164	Wire break
33125	8165	Reserved
33126	8166	No load voltage
33136	8170	Configuration/parameter assignment error
33137	8171	Chassis ground fault
33138	8172	Short circuit to phase (sensor)
33139	8173	Short circuit to ground (sensor)
33140	8174	Wire break
33141	8175	No sensor power supply
33152	8180	Configuration/parameter assignment error
33153	8181	Chassis ground fault
33154	8182	Short circuit to phase
33155	8183	Short circuit to ground
33156	8184	Wire break
33157	8185	Fuse tripped
33158	8186	No load voltage
33159	8187	Excess temperature
33200	81B0	Counter module, signal A faulty
33201	81B1	Counter module, signal B faulty
33202	81B2	Counter module, signal N faulty
33203	81B3	Counter module, incorrect value passed between the channels
33204	81B4	Counter module, 5.2 V sensor supply faulty