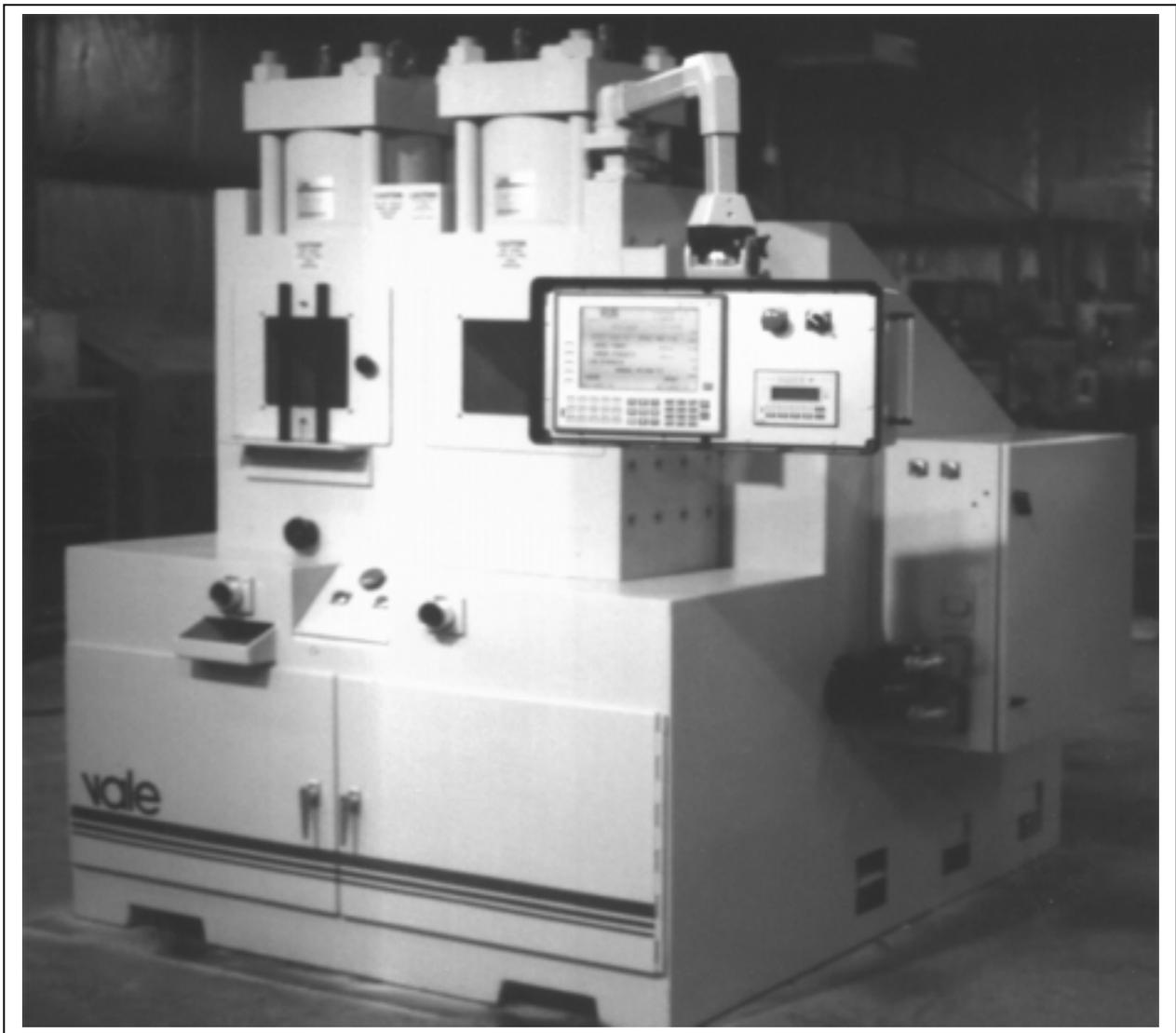


VU-3 CUT
SETUP/OP
RELEASE 1.0
OCTOBER 1999

vale



VU-3 CUT SETUP AND OPERATION USER MANUAL



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SAFETY INSTRUCTIONS

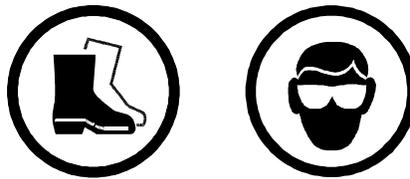


READ THESE INSTRUCTIONS CAREFULLY!
FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN
SEVERE PERSONAL INJURY

OPERATING MACHINE



- READ OPERATING INSTRUCTIONS
- WEAR EYE, FACE, AND FOOT PROTECTION
- INSPECT TOOL DAILY FOR UNSAFE CONDITIONS
- CHECK THAT ALL GUARDS ARE IN PLACE AND ALL SAFETY DEVICES ARE WORKING PROPERLY. DO NOT OPERATE TOOL WITH ANY SAFETY GUARDS REMOVED.
- DO NOT WEAR LOOSE CLOSING OR JEWELRY
- NEVER PUT ANY PART OF YOUR BODY INTO, UNDER, OR NEAR MOVING PARTS
- NEVER OPERATE TOOL ABOVE SPECIFIED PRESSURE
- DO NOT EXCEED RECOMMENDED PERFORMANCE LIMITATIONS



SERVICING MACHINE

- SHUT OFF & LOCK OUT POWER SOURCE TO TOOL
- NEVER LIFT HEAVY TOOLS BY HAND. USE MACHINERY MOVING EQUIPMENT.
- FOLLOW THE MAINTENANCE INSTRUCTIONS IN YOUR MANUAL
- USE THE CORRECT TOOLS TO REPAIR MACHINE



FORWARD

This manual is a reference guide for operation of the **Vale VU-3 CUT UPSET TESTER (Computer controlled Upset Tester)**. It describes the procedure for configuring, setting up and operation of the unit. It should be used by individuals who will be setting up and operating the unit. *This manual should be read thoroughly before operating the equipment.*



OVERVIEW

The VU-3 CUT Upset tester is a Computer controlled hydraulic press designed for use in the testing of steel rod stock. With its CNC controlled proportional valve, high accuracy transducers, and linear encoder, it is capable of holding .0015 accuracy on the upset press. The shear press is equipped with high accuracy transducers, which makes it possible to measure the actual shear strength of the material being sheared. The operator interface is designed to give the user quick and easy access to the setup and configuration of the unit, not to mention alarm, load forces and oil temperature information. The unit is equipped with 2 communication ports, the first port transmits continuous output of the setup parameters and test results of each individual test sample and the second is an input making it possible to setup the parameters of the unit via a remote location. A back-up system has also been incorporated to reduce down time. The back-up system can be used when the main operating system fails, this reverts the unit back to a standard VU-3.

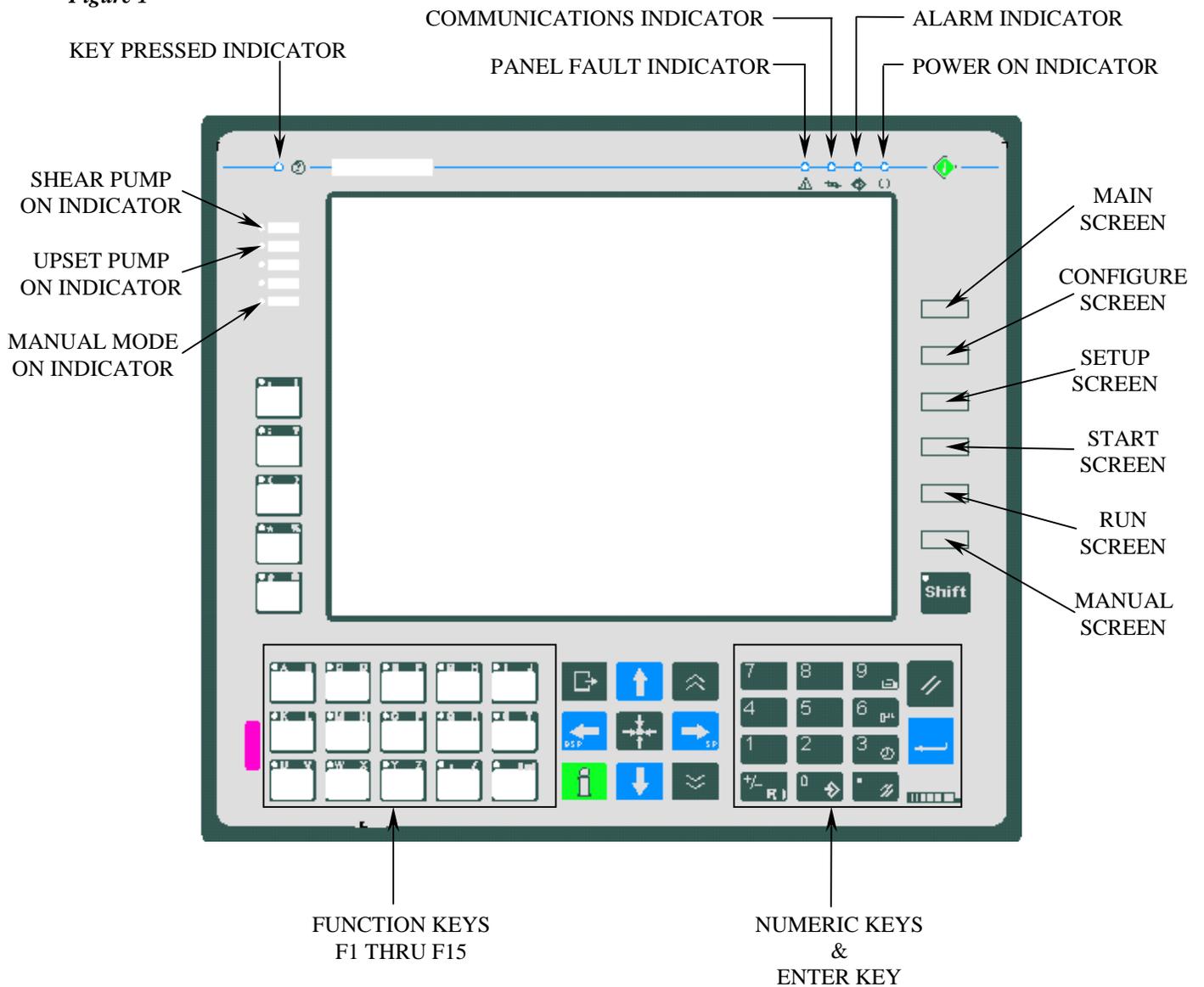


MAIN OPERATOR INTERFACE

The MAIN OPERATOR INTERFACE is a programmable, multi keyed display panel. Because all the functions of the panel were not used for this application not all function keys and indicators work. The following illustration (see figure 1) show which keys and indicators are available.

FUNCTION KEYS & INDICATORS

Figure 1



MAIN (Main Menu Screen)

The MAIN MENU SCREEN is the default start up screen (also referred to as a *PAGE*). On the right hand side of the screen are the menu selection options. This area is referred to as the *MENU FIELD*. The *MENU FIELD* will appear on all pages. Each menu item has an adjacent function key shown in *Figure 2*. By pressing the desired menu item the screen will advance to the page that was selected. This makes it easier to change to any page at any time.

Figure 2



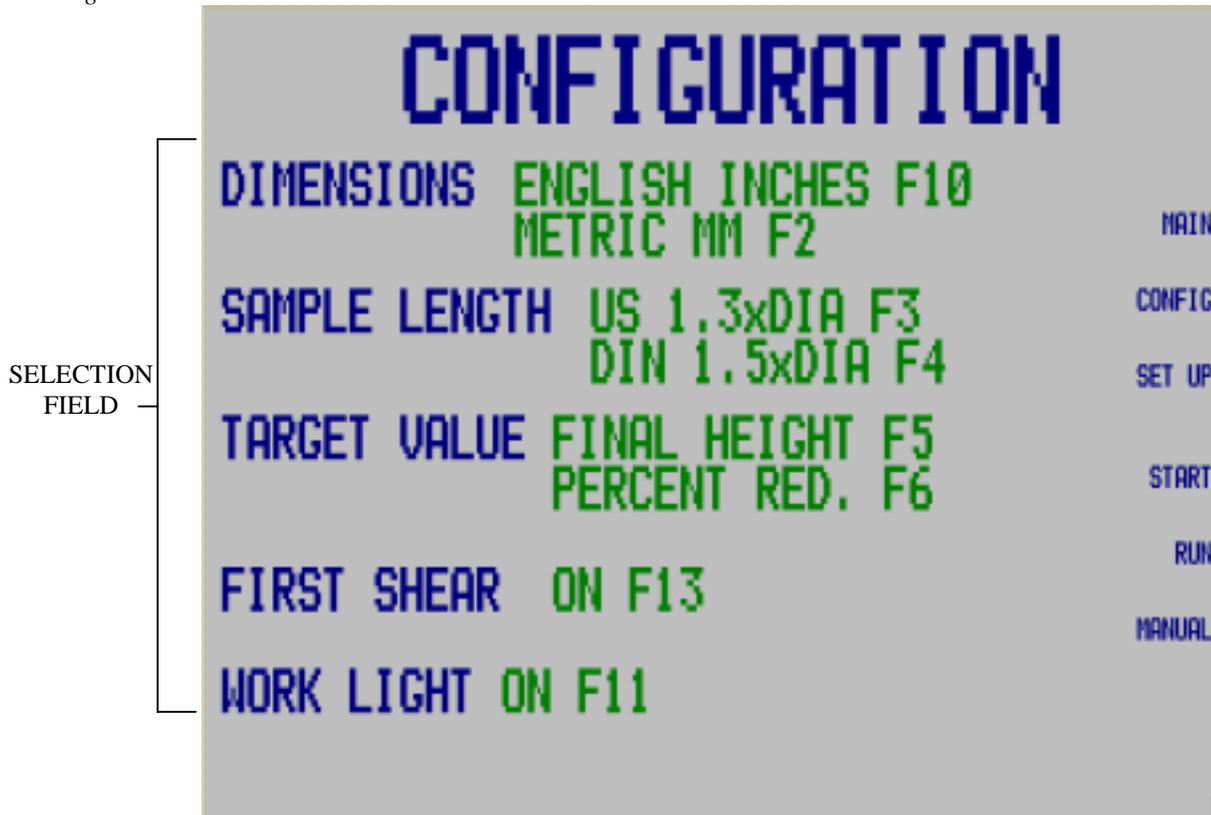
In the bottom left corner is the *INFO FIELD*. The *INFO FIELD* is Vale's address, phone, fax and Internet addresses. This information can be used for technical support, service, parts and product information. The *INFO FIELD* can be displayed at any time by selecting MAIN from the *MENU FIELD*.



CONFIG (Configuration Screen)

The CONFIG SCREEN is used to configure the units die type, dimension style and target value. There are 5 *SELECTION FIELDS*, plus the *MENU FIELD*. The CONFIG screen must be setup after all power up sequences.

Figure 3

**CONFIG SELECTION FIELDS**

DIMENSION FIELD – In this field you will select whether English or Metric dimensioning will be used during operation. This selection must match the die set being used in order for the PLC to calculate proper shear strengths and upset parameters

To select English dimensioning press F10, when English is selected the dimension field will display *ENGLISH SELECTED*.

To select Metric dimensioning press F2, when Metric is selected the dimension field will display *METRIC SELECTED*.

SAMPLE LENGTH FIELD – In this field you will select which DIE SET will be used. This selection must match the die set being used in order for the PLC to calculate proper shear strengths and upset parameters.

To select US STANDARD DIE SET press F3, when US is selected the sample length field will display *US SELECTED*. (*US die sets use 1.3 times the material diameter to determine sample length*).

To select DIN STANDARD DIE SET press F4, when DIN is selected the sample length field will display *DIN SELECTED*. (*DIN standard die sets use 1.5 times the material diameter to determine sample length*).



CONFIG SELECTION FIELDS (cont.)

TARGET VALUE FIELD – In this field you can select whether Final Height or Percent Reduction mode will be used to calculate final upset height.

Using the Final Height selection allows the operator or a remote computer to set the final height of the upset sample. Actual final height is entered in the SET UP SCREEN (*see SET UP SCREEN*).

To select FINAL HEIGHT press F5, when final height is selected the target value field will display *FINAL HEIGHT SELECTED*.

Using the Percent Reduction selection allows the operator or a remote computer to set the percentage of reduction in height based on the sample length of the die set selected. Actual Percent Reduction is entered in the SET UP SCREEN (*see SET UP SCREEN*).

To select PERCENT RED press F6, when percent reduction is selected the target value field will display *PERCENT SELECTED*.

FIRST SHEAR – The FIRST SHEAR is used to calculate minimum and maximum shear strength limits, these limits are calculated by measuring the load force it takes to shear the first sample and adding a percentage above and below the measure force. This feature will be explained more thoroughly in the SETTING MIN/MAX SHEAR LIMITS section (*see SETTING MIN/MAX SHEAR LIMITS*).

To turn FIRST SHEAR on, press F13, when the first shear is turned on the first shear field will display OFF F14. The first shear field will reset after the first shear cycle is completed. *CAUTION: THE FIRST SHEAR SHOULD NOT BE TURNED ON UNTIL THE SHEAR HAS BEEN CALIBRATED (see CALIBRATION)*.

WORK LIGHT – The work light field simply turns the work lights on or off.

To turn the work lights on press F11, when the work lights are on the work light field will display OFF F12.

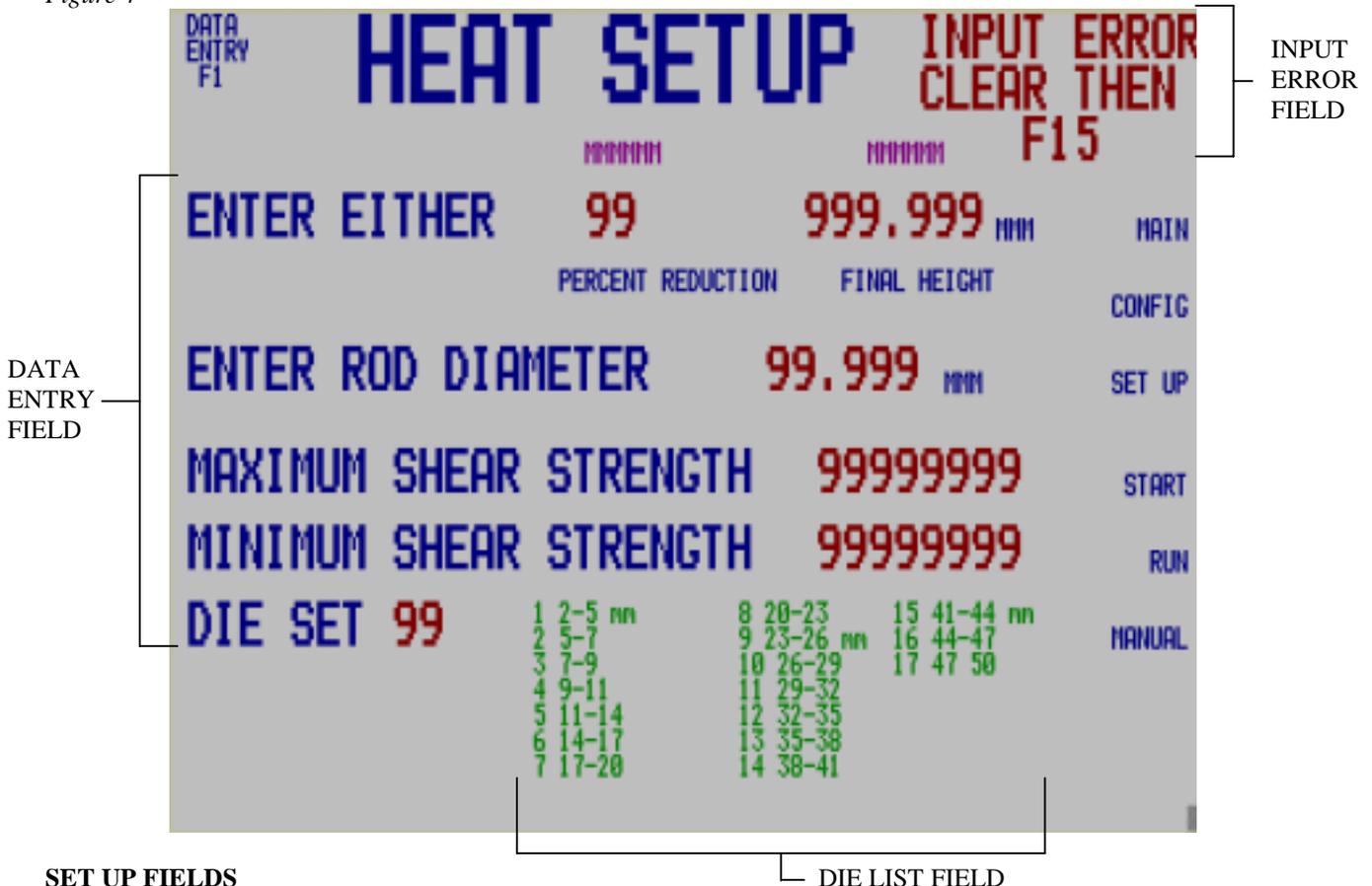
To turn the work lights off press F12, when the work lights are off the work light field will display ON F11



SET UP (Set Up Screen)

The SET UP SCREEN is where the operational parameters are entered. These parameters include final upset height, rod diameter, shear min/max limits and die number. The operational parameters need to be set correctly in order for the equipment to operate properly. The parameters also need to be changed any time the sample material is changed, (i.e. diameter, material grade). The page is divided up into 6 data entry fields, 1 error field and 1 die list field.

Figure 4



SET UP FIELDS

DATA ENTRY FIELDS (see Figure 4)

To enter the *DATA ENTRY FIELDS*, press the F1 key to enable the cursor. The cursor will appear in the first data field (percent reduction). Each consecutive press of the F1 key will advance the cursor to the next data field. To exit the data entry fields, press the ENTER key.

PERCENT REDUCTION FIELD – In this field you can enter the percentage of reduction in height you want the upset press to test the sample to. The final upset height is then calculated by subtracting the percentage of reduction from the shear length. However, this field is only enabled if the *PERCENT RED* was selected in the *TARGET VALUE* field (see *CONFIG SELECTION FIELDS*). To see if the field is enabled, look above the percent reduction field, if the text reads ENTER the field is ENABLED, if the text reads NO the field is DISABLED.



SET UP FIELDS (cont.)**PERCENT REDUCTION FIELD** (cont.)

To change the PERCENT REDUCTION press F1 to enter the data entry field. If the cursor appears in a different field continue pressing F1 to advance the cursor to the percent reduction field. Using the numeric keys, enter the desired percentage of reduction (range = 1 to 99). To lock in the value press ENTER or press F1 to advance to the next field.

NOTE: When using the PERCENT REDUCTION field, the FINAL HEIGHT field will reflect the final height calculated once the percent reduction value has been locked in.

CAUTION: DO NOT OVER UPSET THE SAMPLE. SETTING TO BIG OF A VALUE WITH A SMALL DIAMETER SAMPLE WILL CAUSE DIMPLING AND/OR CRACKING OF THE UPSET PLATTENS.

FINAL HEIGHT FIELD – In this field you can enter an absolute final upset height. Using an absolute value sets the upset press to upset the sample to a pre-determined final height, rather than a calculated final height. However, this field is only enabled if the FINAL HEIGHT was selected in the TARGET VALUE field (see CONFIG SELECTION FIELDS). To see if the field is enabled, look above the final height field, if the text reads ENTER the field is ENABLED, if the text reads NO the field is DISABLED.

To change the FINAL HEIGHT value press F1 to enter the data entry field. If the cursor appears in a different field continue pressing F1 to advance the cursor to the percent reduction field. Using the numeric keys, enter the desired final height value (see NOTE1 below for range issues). To lock in the value press ENTER or press F1 to advance to the next field.

Note 1: When using an absolute final height value, the value entered in the field sets the final height the upset ram will travel to, rather than calculating the value according to the shear length. (The shear length is the length of the sample cut by the shear die being used).

NOTE 2: When using the FINAL HEIGHT field, the PERCENT REDUCTION field will reflect the percentage of upset once the final height value is locked in.

ROD DIAMETER FIELD - This field is used to enter the diameter value of the material to be tested. The diameter value is also used to calculate the MIN/MAX SHEAR LIMITS (see MIN/MAX SHEAR STRENGTH FIELDS). This is a critical value and must be entered correctly, it must also match the DIE SET being used. (See DIE SET FIELD). If to large or to small of a value is entered an INPUT ERROR will appear in the upper right hand corner of the screen and halt machine operation until the error is cleared. (See INPUT ERROR FIELD). To change the ROD DIAMETER value press F1 to enter the data entry field. If the cursor appears in a different field continue pressing F1 to advance the cursor to the ROD DIAMETER FIELD field. Using the numeric keys, enter the desired ROD DIAMETER. To lock in the value press ENTER or press F1 to advance to the next field.

MIN/MAX SHEAR STRENGTH FIELDS – The MIN/MAX SHEAR STRENGTH fields are divided into 2 separate fields. The MAXIMUM SHEAR STRENGTH field sets the upper limit of shear strength load force. The MINIMUM SHEAR STRENGTH field sets the lower limit of shear strength load force. When the limits are set, any time a sample is sheared and the load force goes out of the MIN/MAX range an ALARM is displayed on the RUN SCREEN (see RUN SCREEN). This ALARM is then logged to the DATA OUTPUT PORT "PRT1" (see DATA OUTPUT PORT). There are 2 ways to set these values, MANUALLY and AUTOMATIC. MANUALLY setting the MIN/MAX SHEAR STRENGTH LIMITS is as simple as entering the desired minimum and maximum shear limits. These values are entered as whole numbers equaling force in pounds.
EXAMPLE: If a value of 10000 is entered, then 10000 = 10,000 pounds of force.



SET UP FIELDS (cont.)**MIN/MAX SHEAR STRENGTH FIELDS** (cont.)

AUTOMATIC setting of the MIN/MAX SHEAR STRENGTH LIMITS uses the *FIRST SHEAR* function on the *CONFIG SCREEN* (see *CONFIG SCREEN*) and the MIN/MAX SHEAR PERCENTAGES on the *MANUAL SCREEN* (see *MANUAL SCREEN*). When using this feature, MIN/ MAX SHEAR LIMITS are derived by taking the FIRST SHEAR load force value and calculating the MIN/MAX SHEAR PERCENTAGES above and below the stored value. This feature requires that the FIRST SHEAR be turned on when the first sample is ready to be sheared (*DO NOT TURN ON THE FIRST SHEAR FEATURE UNTIL THE UNIT HAS BEEN CALIBRATED* (see *RUN SCREEN*)).

EXAMPLE: If the FIRST SHEAR value reads as 10000 pounds of force and a MAX SHEAR PERCENTAGE of 10% and a MIN SHEAR PERCENTAGE of 10% is set in the MIN/MAX SHEAR PERCENTAGES FIELDS on the MANUAL SCREEN, then the MIN/MAX SHEAR STRENGTH LIMIT values would be SET at 11000 lbs. MAXIMUM SHEAR STRENGTH AND 9000 lbs. MINIMUM SHEAR STRENGTH.

NOTE: Setting the MIN/MAX SHEAR PERCENTAGES uses a decimal number rather than a percentage. For more information on how to set the MIN/MAX SHEAR PERCENTAGE values see SETTING MIN/MAX SHEAR PERCENTAGES.

SETTING MIN/MAX SHEAR LIMITS

MANUAL SETTING – To manually set the MIN/MAX SHEAR STRENGTH LIMITS press F1 to enter the data entry field. If the cursor appears in a different field continue pressing F1 to advance the cursor to the MAXIMUM SHEAR STRENGTH FIELD. Using the numeric keys enter the desired value for MAXIMUM SHEAR STRENGTH, press F1 again to advance the cursor to the MINIMUM SHEAR STRENGTH FIELD. Using the numeric keys enter the desired value for MINIMUM SHEAR STRENGTH. To lock in the values press ENTER or press F1 to advance cursor to the next field.

AUTOMATIC SETTING – To set the MIN/MAX SHEAR STRENGTH LIMITS automatically see *SETTING MIN/MAX SHEAR PERCENTAGES*.

DIE SET FIELD – The DIE SET FIELD is used to set the DIE NUMBER being used to shear the sample piece. This number tells the processor how to calculate the information gathered during operation.

THIS IS A CRITICAL FIELD AND MUST BE ENTER CORRECTLY. ALL MATHMATICAL CALCULATIONS MADE BY THE PLC ARE DERIVED BY THIS SETTING.

To find out which DIE is being use, look at the front of the DIE. Located on the DIE front will be the DIE NUMBER and its size range. Another way to determine the DIE SET number is to look at the DIE LIST FIELD. For more detailed information on the DIE LIST FIELD see *DIE LIST FIELD*.

To set the DIE SET number press F1 to enter the data entry field. If the cursor appears in a different field continue pressing F1 to advance the cursor to the DIE SET field. Enter the proper DIE number. To lock in the value press ENTER or press F1 to advance to the next field.

DIE LIST FIELD (see Figure 4) – The DIE LIST FIELD is a list of die numbers and its corresponding size ranges. These values match the values on the individual DIES. This list is FACTORY SET and is specified by the DIE SETS ordered at the time of equipment purchase. If a different DIE SET other than the one specified at equipment purchase is going to be used contact **Vale Industries Inc.**



SET UP FIELDS (cont.)

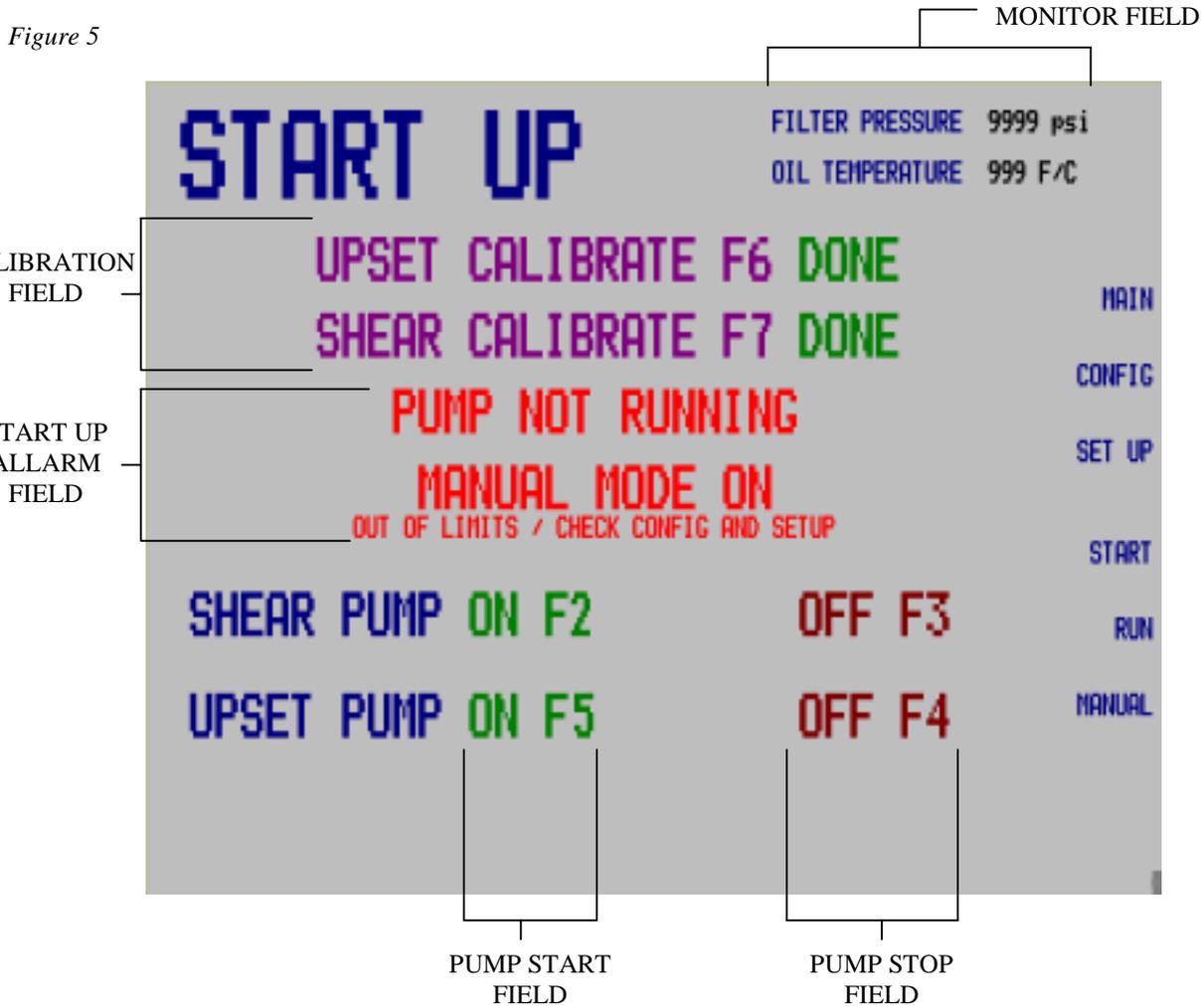
INPUT ERROR FIELD – This field is simply an input error alarm that indicates when a set up value is out of range of the equipment’s capabilities. If no error exists, this field will be clear. If an error exists, the field will read INPUT ERROR CLEAR THEN F15. The INPUT ERROR ALARM will also appear on the START SCREEN and the RUN SCREEN (*see START SCREEN and RUN SCREEN*). To clear the error, change the value that is out of range then press F15 to clear the error.

NOTE: If an error will not clear, contact Vale Industries Inc. @ (815) 756-2426



START UP (Start up screen)

The START UP SCREEN contains the pump start controls and the calibration controls. Also found on this page is a START UP ALARM FIELD and a MONITOR FIELD. The page is divided into 5 fields, PUMP START FIELD, PUMP STOP FIELD, START UP ALARM FIELD, CALIBRATION FIELD, and MONITOR FIELD.



THE PUMP START & STOP FIELDS – The pump start and stop field work in conjunction with one another. This means when a function key is activated, the opposite field will then display its key action, the field that was activated will then display the status of that field.

EXAMPLE: If the shear pump is stopped, the PUMP START FIELD will display ON F2 and the PUMP STOP FIELD will display STOPPED. When the pump is started, by pressing F2, then the PUMP START FIELD will display RUNNING and the PUMP STOP FIELD will display OFF F3.



START UP SCREEN (cont.)**STARTING & STOPPING THE SHEAR PUMP**

To start the SHEAR PUMP press F2. The PUMP START FIELD will then reflect the pump status.
To Stop the SHEAR PUMP press F3. The PUMP STOP FIELD will then reflect the pump status.

STARTING & STOPPING THE UPSET PUMP

To start the UPSET PUMP press F5. The PUMP START FIELD will then reflect the pump status.
To stop the UPSET PUMP press F4. The PUMP STOP FIELD will then reflect the pump status.

NOTE: If the pumps do not start when the function key is activated, check the START UP ALARM FIELD to insure an OUT OF LIMITS ALARM (see START UP ALARM FIELD) condition is not present.

CALIBRATION FIELD – The CALIBRATION FIELD is used to calibrate the equipment after an initial power up. Once the unit is calibrated, it does not need re-calibration until the unit is powered down. The CALIBRATION FIELD is divided into 2 parts. The UPSET CALIBRATE and the SHEAR CALIBRATE.

DANGER!!!!

DO NOT OPERATE THE UNIT UNTIL THE EQUIPMENT HAS BEEN CALIBRATED. OPERATING THE UNIT WITHOUT CALIBRATION CAN CAUSE DAMAGE TO THE EQUIPMENT AND/OR BODILY INJURY.

DO NOT CALIBRATE THE EQUIPMENT WITH MATERIAL IN THE UPSET PRESS OR THE SHEAR PRESS. CALIBRATING TH EQUIPMENT WITH MATERIAL IN THE PRESSES CAN CAUSE DAMAGE TO THE EQUIPMENT AND/OR BODILY INJURY.

UPSET CALIBRATE – The UPSET calibration is achieved by zeroing the linear encoder in its home position (fully retracted) then extending the ram until it touches the bottom platen and loads up to a preset pressure. At this point the ram will retract .100 then it will extend again until it touches the bottom platen again and loads up to the preset pressure. The linear encoder then re-zeros and the ram retracts to its home position. The UPSET PRESS is then calibrated.

To calibrate the UPSET PRESS, be sure the platens and press compartment are clear of all debris and foreign objects. Close the UPSET PRESS safety door. Confirm that the UPSET PUMP is running. If the pump is not running and the UPSET CALIBRATE function key is activated, an ALARM will appear in the START UP ALARM FIELD that reads PUMP NOT RUNNING. Once the pump is running press F6. The UPSET CALIBRATION cycle will then begin.

SHEAR CALIBRATE – The SHEAR calibration is achieved by cycling the SHEAR PRESS 5 times, each time the SHEAR is cycled the PLC logs the force it took to move the ram. The captured values are then averaged. This number is then stored in memory and is subtracted from the SHEAR STRENGTH recorded during operation.

To calibrate the SHEAR PRESS, be sure DIE and the press compartment is clear of all debris and foreign objects. Close the SHEAR PRESS safety door. Confirm that the SHEAR PUMP is running. If the pump is not running and the SHEAR CALIBRATE function key is activated, an ALARM will appear in the START UP ALARM FIELD that reads PUMP NOT RUNNING. Once the pump is running press F7. The SHEAR CALIBRATION cycle will then begin.



START UP SCREEN (cont.)

START UP ALARM FIELD - The ALARM FIELD is designed to give the operator warning of an ALARM condition before calibrating the equipment. The field is located just below the CALIBRATION FIELD (*see Figure 5*). There are 3 distinctive ALARMS in this field.

PUMP NOT RUNNING ALARM – The PUMP NOT RUNNING alarm notifies the operator that the pump has not been started. This alarm will appear when the operator attempts to calibrate either the SHEAR PRESS or the UPSET PRESS with the pumps stopped.

MANUAL MODE ON ALARM – The MANUAL MODE ON alarm indicates to the operator that MANUAL MODE is turn on. Calibration can not be performed if the system is in MANUAL MODE. For more information on MANUAL MODE *see MANUAL SCREEN*.

OUT OF LIMITS / CHECK CONFIG AND SETUP ALARM – The OUT OF LIMITS alarm indicates to the operator that an INPUT ERROR condition exists. If an INPUT ERROR is present the pumps will not start and the unit will not operate until the error is cleared. To clear the error (*see INPUT ERROR FIELD*).

MONITOR FIELD – The MONITOR FIELD is located in the upper right hand corner of the page. It's designed to give the operator information on system conditions (i.e. oil temperature, filter pressure). This MONITOR FIELD is divided into 2 parts.

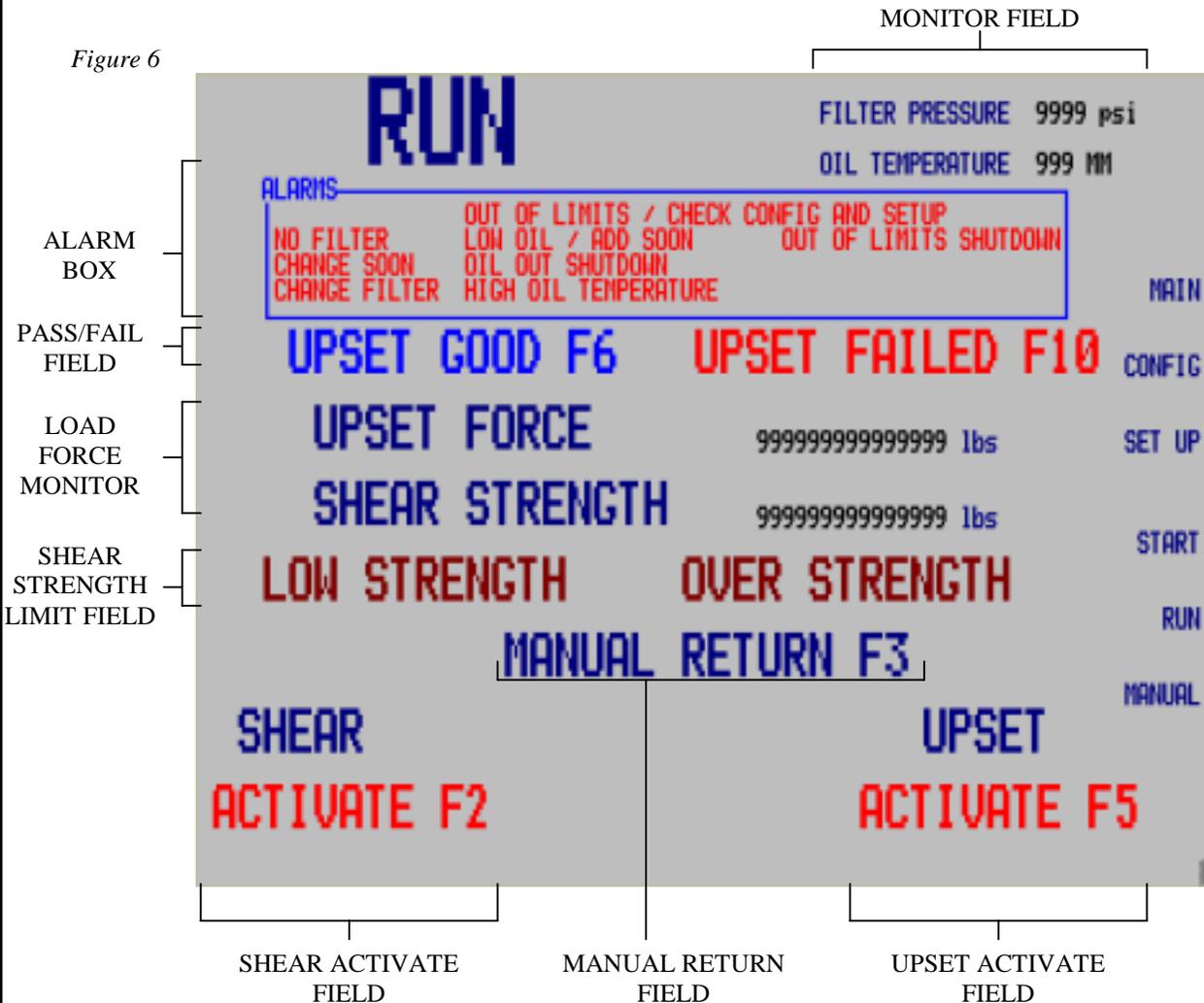
FILTER PRESSURE – The FILTER PRESSURE monitor measures the pressure in psi at the return filter port (*see MAINTENANCE MANUAL* for location of this port). If the FILTER PRESSURE reaches a pre-set upper and lower limit an ALARM will appear on the RUN SCREEN indicating an ALARM condition. For more information on this ALARM (*see RUN SCREEN / OPERATIONAL ALARM FIELD*).

OIL TEMPURATURE – The OIL TEMPERATURE monitor measures the temperature of the oil in the reservoir. If the oil temperature reaches a pre-set limit, the oil cooler will be activated. The oil cooler will then cool the oil down. If the oil temperature does not come down and a second pre-set limit is reached an ALARM will appear on the RUN SCREEN indicating an ALARM condition. For more information on this ALARM (*see RUN SCREEN / ALARM BOX*).



RUN (Run screen)

The RUN SCREEN contains the controls for operating the equipment. The controls include, SHEAR ACTIVATE, UPSET ACTIVATE, UPSET GOOD, UPSET FAILED, AND MANUAL RETURN. In normal operation, the OPERATOR CONTROLS located on the front of the unit will be used to operate the system, rather than using the OPERATOR INTERFACE PANEL (see OPERATOR CONTROLS). Also included on the RUN SCREEN are various MONITOR FIELDS, these fields include a MONITOR FIELD (as on the SET UP SCREEN), ALARM BOX, LOAD FORCE FIELD, and a SHEAR STRENGTH LIMIT FIELD.



RUN SCREEN (cont.)**CONTROLS**

SHEAR ACTIVATE FIELD – This field can be use to activate the SHEAR PRESS. After the unit has been set up, configured, and calibrated this function will be enabled. To activate the SHEAR PRESS, press F2.

UPSET ACTIVATE FIELD – This field can be used to activate the UPSET PRESS. After the unit has been set up, configured, and calibrated this function will be enabled. To activate the UPSET PRESS, press F5.

PASS/FAIL FIELD – The PASS/FAIL FIELD is used to confirm whether a test sample PASSED or FAILED the UPSET test. *EXAMPLE: After the upset cycle, the operator would then inspect the sample, if the operator finds cracks on the sample he/she would then press F10 to confirm the sample failed.* This confirmation is then stored in memory until the next sample is run. This stored data is then used for print out and/or tracking (*see DATA OUT PORT*).

To pass a sample press F6, the UPSET GOOD FIELD will then display PASSED UPSET.
To fail a sample press F10, the UPSET FAILED FIELD will then display UPSET FAILED

NOTE 1: The SHEAR ACTIVATE, UPSET ACTIVATE, and PASS/FAIL functions can also be initiated by using the OPERATOR CONTROLS located on the front of the unit (see OPERATOR CONTROLS).

NOTE 2: The sequence of operation is critical to the way the PLC stores and processes the data for the DATA OUT PORT. If the OPERATION SEQUENCE is not followed the DATA OUTPUT will then be invalid (see OPERATION SEQUENCE).

MANUAL RETURN FIELD – The MANUAL RETURN function is designed to be use when a system error occurs and stops the unit in the middle of a cycle. To get the press rams to return to there home position after clearing the system error the operator would use the MANUAL RETURN function. The MANUAL RETURN function is enabled as long as the SHEAR PUMP and the UPSET PUMPS are running. System errors can include power outage, high oil temperature, oil out, and activation of the EMERGENCY STOP. To use MANUAL RETURN, be sure pumps are running, then press F3. The rams will then return to there home position.

WARNING: If a power outage occurs, the system will need to be set up and calibrated after power up. If the presses where in mid cycle at the time of power outage, the MANUAL RETURN function will need to be used to return the rams to there home position before calibration is activated.

MONITORS

MONITOR FIELD – The MONITOR FIELD is located in the upper right hand corner of the page. It's designed to give the operator information on system conditions (i.e. oil temperature, filter pressure). This MONITOR FIELD is divided into 2 parts.

FILTER PRESSURE – The FILTER PRESSURE monitor measures the pressure in psi at the return filter port (see MAINTENANCE MANUAL for location of this port). If the FILTER PRESSURE reaches a pre-set upper and lower limit an ALARM will appear on the RUN SCREEN indicating an ALARM condition. For more information on this ALARM (*see RUN SCREEN / OPERATIONAL ALARM FIELD*).



RUN SCREEN (cont.)**MONITORS** (cont.)

OIL TEMPURATURE – The OIL TEMPERATURE monitor measures the temperature of the oil in the reservoir. If the oil temperature reaches a pre-set limit, the oil cooler will be activated. The oil cooler will then cool the oil down. If the oil temperature does not come down and a second pre-set limit is reached an ALARM will appear on the RUN SCREEN indicating an ALARM condition. For more information on this ALARM (see *RUN SCREEN / ALARM BOX*).

LOAD FORCE MONITOR – The LOAD FORCE MONITOR field displays the actual load force captured during the cycle of the SHEAR PRESS and the UPSET PRESS.

UPSET FORCE – UPSET FORCE is the amount of force in pounds it takes to compress the sample to the given upset value (*i.e. PERCENT REDUCTION or FINAL HEIGHT (see SET UP SCREEN)*). At the end of the upset cycle, the captured value is then displayed in the UPSET FORCE field. This value is for reference only and is not stored in memory for DATA OUT. (*See DATA OUT PORT for available DATA OUT values*).

SHEAR STRENGTH – SHEAR STRENGTH is the amount of force in pounds it takes to shear the sample material. This value is calculated by using the values that are set in the SET UP SCREEN (*see SET UP SCREEN*). If the values set in SET UP SCREEN are wrong, the SHEAR STRENGTH force value will then be invalid. At the end of the shear cycle, the captured value is then displayed in the SHEAR STRENGTH field. This value is also stored in memory for use by the DATA OUT PORT (*see DATA OUT PORT*).

SHEAR STRENGTH LIMIT FIELD – The SHEAR STRENGTH LIMIT field indicates whether or not the present shear cycle is within the MIN/MAX SHEAR LIMIT established on the SET UP SCREEN (*see MIN/MAX SHEAR STRENGTH FIELDS for setting min/max shear limits*). If the shear sample falls within the min/max limit, the field will be clear, if a sample falls under the min/max limit the field will display LOW STRENGTH, if the shear sample goes over the min/max limit the field will display OVER STRENGTH. The values in the SHEAR STRENGTH LIMIT field are also stored to memory for use by the DATA OUT PORT (*see DATA OUT PORT*).

ALARM BOX – To better protect the equipment and the operator a set of safety checks has been written into the logic of the PLC. The safety checks monitor the more critical aspects of the equipment, such as FILTER PRESSURE, OIL LEVEL, OIL TEMPURATURE, and MACHINE LIMITATIONS. When these monitor points reach a critical state, an alarm is displayed in the ALARM BOX indicating to the operator that the system is in need of immediate attention. There are 3 ALARM LEVELS. The first being a WARNING (no action is taken by the PLC), the second is an OPERATION FAULT (the system operations are halted until errors are cleared), and the third is an OUT OF LIMITS SHUTDOWN (the system is completely shut down including pumps until the critical error is corrected). If no alarms are present, the ALARM BOX will be clear. The following describes the ALARMS that will appear in the ALARM BOX and their ALARM LEVEL.

LEVEL 1 – WARNING

CHANGE SOON – This alarm indicates that the RETURN OIL FILTER is getting contaminated and needs to be changed soon. (*For information on changing the RETURN OIL FILTER reference the VU-3 CUT MAINTENANCE MANUAL*).



RUN SCREEN (cont.)**LEVEL 1 – WARNING** (cont.)

LOW OIL / ADD SOON – This alarm indicates that the RESERVOIR OIL LEVEL is running low, and oil needs to be added. (For information on adding and changing the oil, reference the VU-3 CUT MAINTENANCE MANUAL).

HIGH OIL TEMPERATURE – The HIGH OIL TEMPERATURE alarm indicates that the reservoir oil temperature is running hot. A high oil temperature could indicate that there is no or low water flow on the cooling system if a water cooled system is being used, or there is insufficient air flow over the radiator if an air cooled system is being used. The HIGH OIL TEMPERATURE alarm will be activated at 130°F / 54°C.

LEVEL 2 – OPERATION FAULT

OUT OF LIMITS / CHECK CONFIG AND SETUP – This alarm indicates that the CONFIG and/or the SET UP parameters are out of the limits of the machine. When this alarm is activated, operation of the machine is halted until the parameters are properly set and the error is cleared (*see SET UP SCREEN for clearing errors*).

LEVEL 3 – OUT OF LIMITS SHUTDOWN (*An out of limits alarm will shut the system down automatically to protect the unit. This shut down includes the pumps*).

NO FILTER – This alarm indicates that there is no RETURN OIL FILTER installed. The alarm will activate when the filter pressure drops below 3psi @ 100°F for 2minutes. To correct this alarm install a RETURN OIL FILTER (reference the VU-3 CUT MAINENANCE MANUAL for information on installing the filter).

CHANGE FILTER - The CHANGE FILTER alarm indicates that the RETURN OIL FILTER is contaminated to the point filter bypass and needs to be changed immediately. The alarm will activate when the FILTER PRESSURE reaches 75psi @ 100°F for 2 minutes. To correct this alarm, change the RETURN OIL FILTER (*see VU-3 CUT MAINTENANCE MANUAL for information on changing the filter*).

OIL OUT SHUTDOWN – This alarm indicates when the OIL LEVEL is below the safe oil level limit for machine operation. To correct this alarm, ADD OIL (*see the VU-3 CUT MAINTENANCE MANUAL for information on adding oil*).

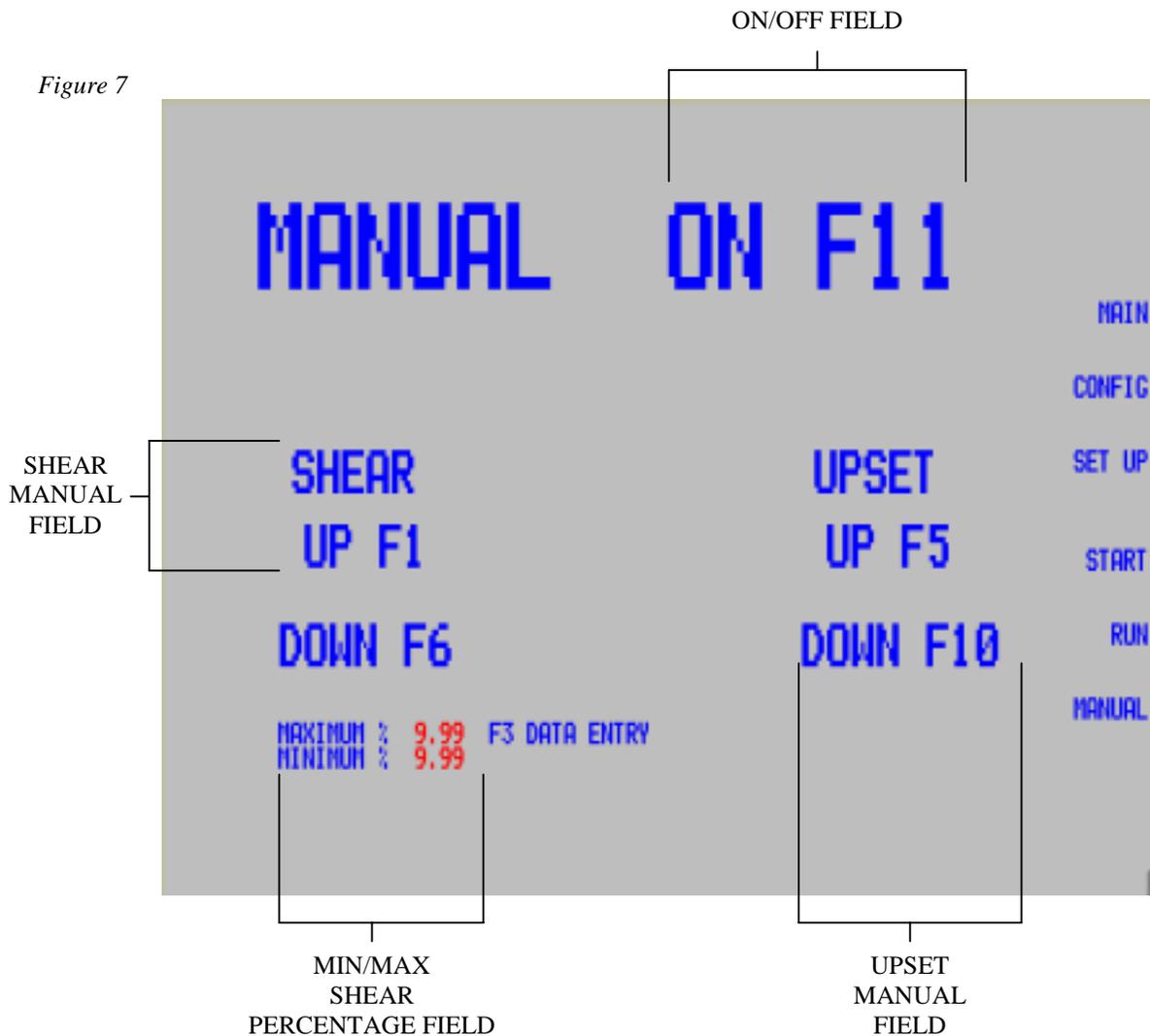
OUT OF LIMITS SHUTDOWN – The OUT OF LIMITS SHUTDOWN alarm indicates that one of the previous LEVEL 3 alarms is active. This alarm is also activated when the reservoirs oil temperature reaches the over temperature limits. This limit is set at 135°F / 51.5°C. The HIGH OIL TEMPERATURE alarm will also be activated if the OUT OF LIMITS SHUT DOWN is due to high oil temperature. A high oil temperature could indicate that there is no or low water flow on the cooling system if a water cooled system is being used, or there is insufficient air flow over the radiator if an air cooled system is being used.



MANUAL (Manual Screen)

The MANUAL SCREEN is designed to give the operator manual controls for moving the UPSET PRESS or the SHEAR PRESS rams. Also included on this page are the MIN/MAX SHEAR PERCENTAGE FIELDS for setting the MIN/MAX SHEAR STRENGTH LIMITS. This page is divided into 4 fields, the ON/OFF FIELD, SHEAR MANUAL FIELD, UPSET MANUAL FIELD, and the MIN/MAX SHEAR PERCENTAGE FIELD.

Figure 7



MANUAL (cont.)

ON/OFF FIELD – The ON/OFF FIELD simply turns the MANUAL MODE on and off. When MANUAL MODE is turned on CALIBRATION and OPERATION of the unit is turned off, this means that the rams will only move by using the MANUAL MODE function keys.

To turn MANUAL MODE on press F11. When MANUAL MODE is turned on the ON/OFF FIELD will display OFF F15.

To turn MANUAL MODE off press F15. When MANUAL MODE is turned off the ON/OFF FIELD will display ON F11.

SHEAR MANUAL FIELD – This field allows the manual movement of the SHEAR PRESS RAM up or down.

To move the SHEAR PRESS RAM down press F1.

To move the SHEAR PRESS RAM up press F6.

UPSET MANUAL FIELD – This field allows manual movement of the UPSET PRESS RAM up or down.

To move the UPSET PRESS RAM down press F5.

To move the UPSET PRESS RAM up press F10.

MIN/MAX SHEAR PERCENTAGE FIELD – This field is where the MIN/MAX SHEAR PERCENTAGES are entered. These values are then used to calculate the MIN/MAX SHEAR STRENGTH LIMITS (*see MIN/MAX SHEAR STRENGTH LIMITS*) on the SET UP SCREEN.

SETTING THE MIN/MAX SHEAR PERCENTAGES – The MIN/MAX SHEAR PERCENTAGES are entered as a decimal number rather than a percentage number. To better understand how these numbers are entered look at the following examples.

If a SHEAR PERCENTAGE of 10% above FIRST SHEAR is required then a value of 1.10 would be entered in the MAXIMUM % FIELD. Because the 1 = the FIRST SHEAR and the .1 = 10% above the FIRST SHEAR value then 1.10 would equal 10% above the FIRST SHEAR.

EXAMPLE: If the FIRST SHEAR = 1000 lbs. And the MAX SHEAR PERCENTAGE = 1.10 Then the MAX SHEAR LIMIT would be set at 1100 lbs.

If a SHEAR PERCENTAGE of 10% below FIRST SHEAR is required then a value of 0.90 would be entered in the MINIMUM % FIELD. Because 1 = the FIRST SHEAR and the percentage value is set below 1, then the desired percentage is subtracted from 1 which = 100%. The remainder is then entered in the MIN % FIELD.

EXAMPLE: If the FIRST SHEAR = 1000 lbs. And the MIN SHEAR PERCENTAGE = 0.90. Then the MIN SHEAR LIMIT would be set at 900 lbs.

To set the MAX % press F3 to enter DATA FIELD, if cursor is not in the MAX % FIELD, press F3 again to advance cursor to the MAX % FIELD. Enter desired value, then press enter to lock in the value.

To set the MIN % press F3 to enter DATA FIELD, if cursor is not in the MIN % FIELD, press F3 again to advance cursor to the MIN % FIELD. Enter desired value, then press enter to lock in the value.



OPERATOR CONTROLS

The OPERATOR CONTROLS are located on the front of the VU-3 CUT (see figure 8). These controls can be used for system operation once the system has been configured and setup. There are 5 OPERATOR CONTROLS.

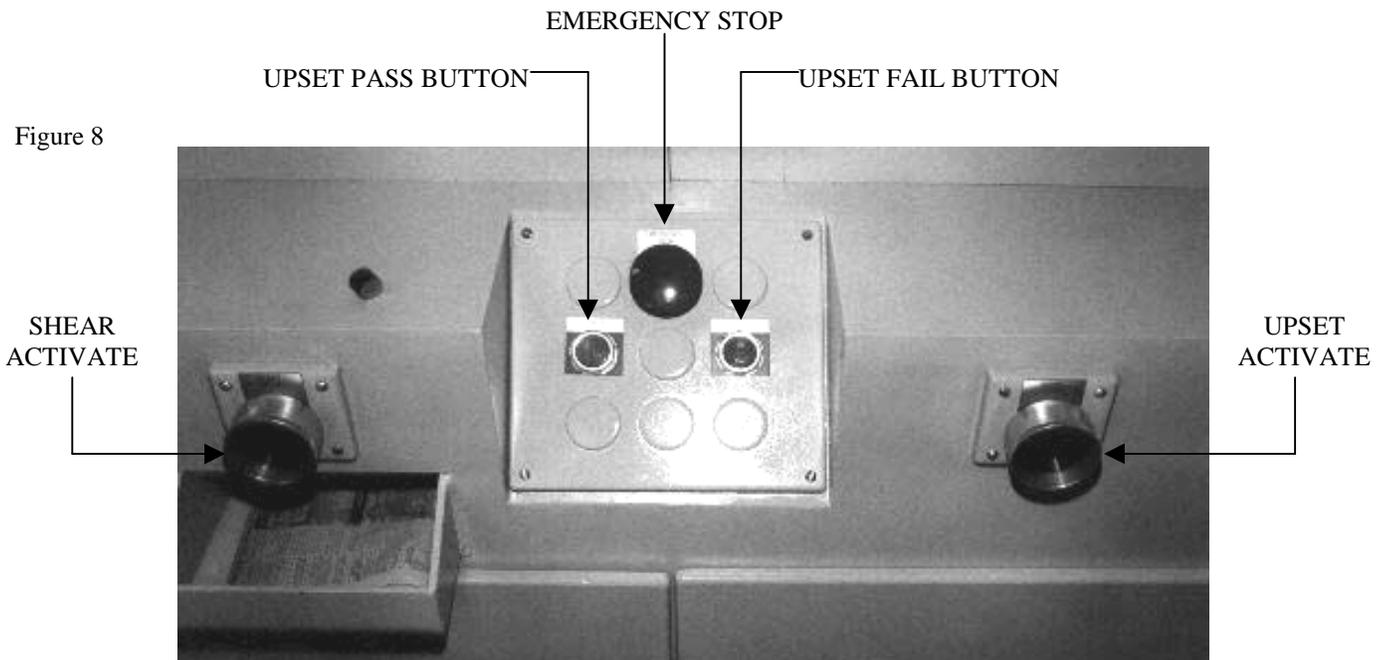
EMERGENCY STOP – The E-STOP button allows the operator to shut all system power off in the event of an EMERGENCY SITUATION.

UPSET PASS BUTTON – The PASS button allows the operator to enter a SAMPLE PASSED value to the PLC after inspecting the sample.

UPSET FAIL BUTTON – The Fail button allows the operator to enter a SAMPLE FAILED value to the PLC after inspecting the sample.

SHEAR ACTIVATE – The SHEAR ACTIVATE button starts the shear cycle.

UPSET ACTIVATE – The UPSET ACTIVATE button starts the upset cycle



OPERATION SEQUENCE

The OPERATION SEQUENCE refers to the order in which the SHEAR ACTIVATE, UPSET ACTIVATE, and the PASS/FAIL buttons are pressed. The OPERATION SEQUENCE controls the way the DATA OUTPUT PORT stores the captured values during the SHEAR and UPSET cycles. To better understand how the DATA OUTPUT is acquired and transmitted, the following illustration shows the OPERATION SEQUENCE and a definition of how the DATA OUTPUT PORT processes the information.

1. **SHEAR ACTIVATE** – After shear activation the captured shear strength is stored in memory, the PLC then determines whether the value is within the MIN/MAX SHEAR STRENGTH LIMITS. The results are then held in memory until it is called to the DATA OUTPUT PORT.

NOTE: If the SHEAR ACTIVATE button is pressed a second time before the rest of the sequence is performed then the value stored during the first cycle will be over written. This will throw the DATA OUTPUT out of sequence making the data invalid. If the rest of the sequence is finished with the second shear cycle value, then the PLC will then ignore the command to transmit the data to the DATA OUTPUT PORT until the next sequence is performed.

2. **UPSET ACTIVATE** – After upset activation, the captured value is stored in memory, then waits for the operator to accept or reject the sample by pressing a PASS or FAIL button.

NOTE: After the UPSET PRESS has been activated it CAN NOT be activated again until a PASS or FAIL selection has been made.

3. **PASS/FAIL BUTTONS** – After the sample has been visually inspected, a PASS or FAIL button is pressed. If the PASS button is press then the PLC stores a PASSED value in memory. If the FAIL button is pressed then a FAILED value is stored into memory. When either a PASS or FAIL button is pressed, the PLC then transmits all the stored values in memory to the DATA OUTPUT PORT and resets the system for the next sequence.

OPERATION SEQUENCE = SHEAR ACTIVATE → UPSET ACTIVATE → PASS or FAIL

NOTE: If the DATA OUTPUT PORT is not being used then the OPERATION SEQUENCE does not apply, however, the UPSET ACTIVATE button will be disabled after each UPSET CYCLE until a PASS or FAIL has been selected.

DATA OUTPUT PORT (PRT1)

The VU-3 CUT has the capability of outputting data acquired during operation of the unit. This data includes MIN SHEAR STRENGTH LIMIT, MAX SHEAR STRENGTH LIMIT, OVER/UNDER SHEAR STRENGTH, SAMPLE DIAMETER, UPSET PASS/FAIL, PERCENT REDUCTION IN HEIGHT, DIE SET NUMBER, and FINAL HEIGHT. The data is exported via the PRT1 port. The PRT1 port is located on the 1746-BAS module, this module is in SLOT 8 of the SLC500 rack. The output is in ASCII protocol and can be used to print directly to a printer using the cable set up specified on drawing number A-5090. The output can also be used to export data directly to another PC using the cable set up specified on drawing number A-5091.



DATA OUTPUT PORT (cont.)

In order for the DATA OUTPUT PORT to export the correct data for the individual samples tested, an operational sequence must be followed. This sequence allows the PLC to store the correct test results with respect to the sample tested. If the proper sequence is not followed then the data output will be out of sequence with the sample being tested. For more information on operation sequence see OPERATION SEQUENCE.

DATA INPUT PORT (PRT2) (Optional)

An optional DATA INPUT PORT is available for customers who require the setting of the SET UP parameters via a remote location. This option is generally customized to the customer specifications.

For more information on this option contact Vale Industries Inc.



BACK UP OPERATING SYSTEM

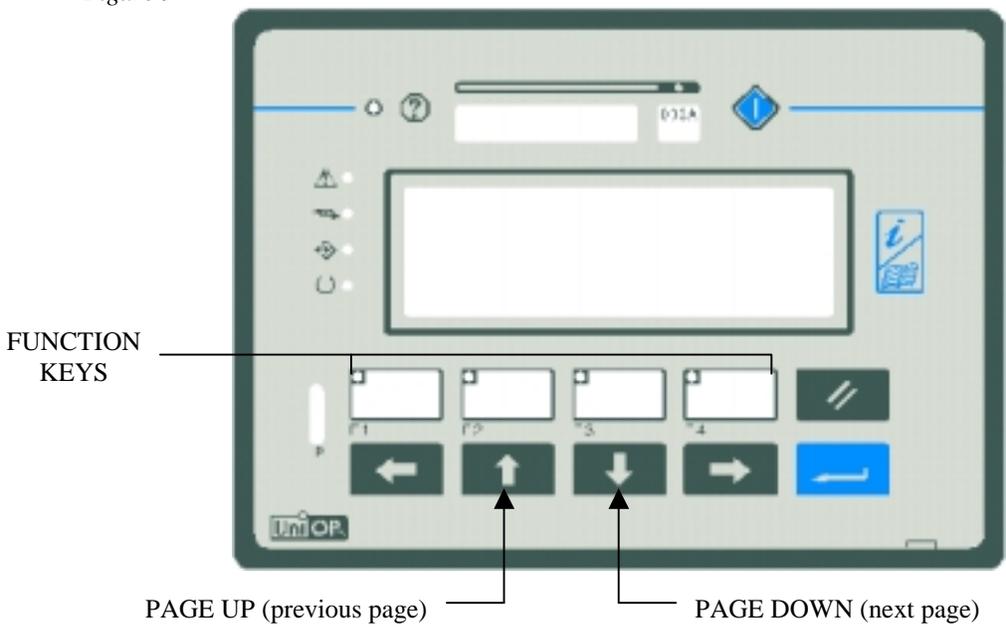
The BACK UP OPERATING SYSTEM is designed to keep the equipment operating when the MAIN OPERATING SYSTEM goes down. This helps keep the product line running while the MAIN OPERATING SYSTEM is being repaired. The BACK UP SYSTEM does not hold all the features the MAIN OPERATING SYSTEM has, but rather sets the unit into a manual operational mode. The following describes how to use the BACK UP SYSTEM.

STARTING THE BACK UP SYSTEM – To start the BACK UP SYSTEM, turn the selector switch located on the pendant arm box to BACK UP. Press the PLC START button located on the PLC control cabinet. The system will then start up using the BACK UP SYSTEM.

BACK UP OPERATOR INTERFACE

The BACK UP OPERATOR INTERFACE is a simple interface primarily used to start and stop the SHEAR PUMP and UPSET PUMP the only other function is a MANUAL RETURN. The interface operation is divided into 4 parts. Each part is referred to as a PAGE. The following describes each PAGE and its function.

Figure 9



BACK UP OPERATOR INTERFACE (CONT.)

PAGE 1 (Start up page) - This page simply indicates to use the down arrow to advance to the next page and the up arrow to go back to the previous page (See Figure 9).

PAGE 2 (SHEAR PUMP start page) – This page is used to start the SHEAR PUMP
To start the SHEAR PUMP press F1
To stop the SHEAR PUMP press F4

PAGE 3 (UPSET PUMP start page) – This page is used to start the UPSET PUMP
To start the UPSET PUMP press F1
To stop the UPSET PUMP press F4

PAGE 4 (MANUAL RETURN page) This page is used to return the press rams to there home position (fully retracted). This function can be used if the system is halted during the middle of a cycle.

NOTE: A HIGH OIL TEMPERATURE ALARM is also displayed on all pages when a HIGH OIL TEMPERATURE condition exists.

RUNNING THE SYSTEM IN BACK UP MODE - Running the VU-3 CUT in BACK UP MODE is done by using the operator controls located on the front of the unit (see OPERATOR CONTROLS) with the exception of the PASS/FAIL button, they are disabled in BACK UP MODE.

ADJUSTING FINAL UPSET HEIGHT IN BACK UP MODE - You can adjust the FINAL UPSET HEIGHT by using the MANUAL HEIGHT ADJUSTMENT located on the right side of the UPSET PRESS.

To set the final height, turn the MANUAL ADJUSTMENT KNOB clockwise to increase the final UPSET HEIGHT or counterclockwise to decrease the final UPSET HEIGHT. Continue adjusting until the desired final height is achieved.



STEP BY STEP OPERATION

- 1) TURN POWER ON. WAIT FOR SYSTEM TO START UP.
Menu selection will appear on the right side of the display.
- 2) SELECT CONFIG FROM THE MENU FIELD.
 - a) SELECT ENGLISH OR METRIC DIMENSIONS (*Metric is default*).
 - b) SELECT US OR DIN STANDARD DIE SET (*US is default*).
 - c) SELECT FINAL HEIGHT OR PERCENT REDUCTION (*Percent is default*).
 - d) TURN ON WORK LIGHTS.
- 3) SELECT SETUP FROM THE MENU FIELD.
 - a) PRESS F1 TO ENTER FIRST DATA FIELD (*First data field is Percent Reduction*).
 - i) IF PERCENT REDUCTION WAS SELECTED IN THE CONFIG SCREEN ENTER DESIRED PERCENTAGE THEN PRESS F1 TWICE TO ADVANCE CURSOR TO THE DIAMETER FIELD.
 - ii) IF FINAL HEIGHT WAS SELECTED IN THE CONFIG SCREEN PRESS F1 ONCE TO ADVANCE CURSOR TO THE FINAL HEIGHT FIELD. ENTER DESIRED HEIGHT THEN PRESS F1 TO ADVANCE CURSOR TO THE DIAMETER FIELD.
 - iii) ENTER THE DIAMETER THAT WILL BE TESTED THEN PRESS F1 TO ADVANCE CURSOR TO THE MAX SHEAR STRENGTH FIELD.
 - iv) IF THE MIN/MAX SHEAR LIMITS WILL BE CALCULATED BY THE FIRST SHEAR THEN PRESS F1 TWICE TO ADVANCE CURSOR TO THE DIE SET NUMBER FIELD. (*In order for the MIN/MAX Shear limits to be calculated by the FIRST SHEAR. The FIRST SHEAR will need to be turned on in the CONFIG SCREEN and the MIN/MAX percentages must be entered in the MANUAL SCREEN. The FIRST SHEAR must not be turned on until the shear has been calibrated. Calibration is done in the START SCREEN. To set the MIN/MAX Percentages see Section 4*).
 - v) IF MIN/MAX SHEAR STRENGTH LIMIT IS KNOWN, ENTER THE MAX VALUE THEN PRESS F1 TO ADVANCE CURSOR TO THE MIN FIELD, ENTER MIN VALUE THEN PRESS F1 TO ADVANCE CURSOR TO THE DIE SET NUMBER FIELD.
 - vi) SELECT THE DIE SET NUMBER THAT WILL BE USED TO SHEAR THE MATERIAL (*The DIE SET NUMBER must match the value entered in the DIAMETER FIELD. If the wrong number is entered the PLC will calculate invalid values and an OUT OF LIMITS ALARM will occur and halt the system. The DIE SET number and its size range can be found on the front of the DIE. These numbers and sizes also appear to the right of the DIE SET NUMBER field*).
 - vii) PRESS THE ENTER KEY TO EXIT THE DATA ENTRY FIELD AND LOCK IN THE VALUES.
 - viii) TO CHANGE ANY OF THE VALUES SET, PRESS THE F1 KEY TO RE-ENTER THE DATA ENTRY FIELD. CONTINUE PRESSING THE F1 KEY TO ANVANCE THE CURSOR TO THE FIELD TO BE CHANGED. WHEN FINISHED PRESS THE ENTER KEY TO LOCK AND EXIT THE DATA ENTRY FIELD.



STEP BY STEP (cont.)

- 4) SELECT MANUAL FROM THE MENU FIELD (*If MIN/MAX values are entered in manually in the SETUP SCREEN skip this section*).
- PRESS F3 TO ENTER MAX SHEAR STRENGTH PERCENTAGE FIELD.
 - ENTER DESIRED PERCENTAGE THEN PRESS F3 TO ADVANCE CURSOR TO THE MIN SHEAR STRENGTH PERCENTAGE FIELD.
 - ENTER THE DESIRED PERCENTAGE THEN PRESS THE ENTER KEY TO LOCK AND EXIT THE PERCENTAGE FIELDS.
 - TO RE-ENTER THE PERCENTAGE FIELDS PRESS F3.

NOTE:

The MIN/MAX Shear Limits are set by calculating the MIN/MAX shear Percentages entered in the MANUAL SCREEN and the FIRST SHEAR load value. When the FIRST SHEAR is turned on in the CONFIG SCREEN (after the shear has been calibrated) and the shear is activated for the first time, the shear load value for the material being sheared is captured. The MAX SHEAR PERCENTAGE is then added to the captured value and the calculated number is then set into the MAX SHEAR STRENGTH LIMIT. The MIN SHEAR PERCENTAGE is then subtracted from the captured value and the calculated number is then set into the MIN SHEAR STRENGTH LIMIT.

EXAMPLE:

If the FIRST SHEAR load value is 10,000 and a MAX PERCENTAGE is set at 1.10% and MIN PERCENTAGE is set at 0.90% then the MAX LIMIT would be set at 11,000 lbs. and a MIN LIMIT would be set at 9,000 lbs. This would give a MIN/MAX LIMIT of $\pm 10\%$. Because 1 is equal to the FIRST SHEAR load value then 1.10 is 10% above FIRST SHEAR and 0.9 is 10% below FIRST SHEAR.

If a sample is below the set MIN SHEAR STRENGTH LIMIT an UNDER STRENGTH alarm will appear on the RUN SCREEN. If a sample is above the MAX SHEAR STRENGTH LIMIT an OVER STRENGTH alarm will appear on the RUN SCREEN.

If no material is in the shear during the FIRST SHEAR, the MIN/MAX SHEAR STRENGTH LIMITS will be invalid and all consecutive shears will show as OVER STRENGTH. To reset the MIN/MAX LIMITS select CONFIG from the MENU FIELD and turn the FIRST SHEAR on. Put the material in the die and activate the shear.

- 5) SELECT START FROM THE MENU FIELD
- PRESS F2 TO START THE SHEAR PUMP.
 - PRESS F5 TO START THE UPSET PUMP.
 - PRESS F6 TO CALIBRATE THE UPSET PRESS.
 - PRESS F7 TO CALIBRATE THE SHEAR PRESS.

NOTE:

If MIN/MAX SHEAR STRENGTH LIMITS are to be set by percentages set on the MANUAL SCREEN then the FIRST SHEAR must be turned on in the CONFIG SCREEN.
"DO NOT TURN ON THE FIRST SHEAR UNTIL THE CALIBRATIONS ARE FINISHED"



STEP BY STEP (cont.)

6) SELECT RUN FROM THE MENU FIELD

To insure a proper print out, the following run sequence should be followed.

- a) INSERT MATERIAL INTO THE DIE.
- b) ACTIVATE SHEAR BY PRESSING F2 ON THE RUN SCREEN OR PRESSING THE PALM BUTTON BELOW THE SHEAR PRESS.
- c) INSERT CUT SAMPLE INTO UPSET PRESS.
- d) ACTIVATE UPSET PRESS BY PRESSING F5 ON THE RUN SCREEN OR PRESSING THE PALM BUTTON BELOW THE UPSET PRESS.
- e) INSPECT SAMPLE
- f) IF SAMPLE PASSED, PRESS F5 ON THE RUN SCREEN OR PRESS THE GREEN BUTTON LOCATED BETWEEN THE SHEAR AND UPSET PRESS.
- g) IF SAMPLE FAILED, PRESS F10 ON THE RUN SCREEN OR PRESS THE RED BUTTON LOCATED BETWEEN THE SHEAR AND THE UPSET PRESS.

NOTE:

After the UPSET press has been activated for the first time it will not activate again until a PASS or FAIL has been selected. Once a PASS or FAIL is selected the PLC will send the DATA to the printer.

If the SHEAR is activated before a PASS or FAIL is selected the string of DATA waiting to be printed will be overwritten. A PASS or FAIL will still have to be selected to get the UPSET press to activate. The DATA will now print on the next UPSET and PASS/FAIL sequence. The pervious sample should be discarded.

SHUT DOWN

To shut the unit down, go to the START SCREEN, stop the SHEAR PUMP by pressing the F3 key and stop the UPSET PUMP by pressing the F4 key.

Shut off the power.

NOTE:

The unit will have to be SETUP and CALIBRATED again after power up. This includes the FIRST SHEAR.

