English

Installation, Operation and Maintenance Instructions

Muncher Control System

NOV Mono®

MPA586/2

One Company, Unlimited Solutions

This operating and Maintenance Instruction covers two types of Muncher Control Systems, Blackmont and Roles. Please ensure you refer to the correct Model before proceeding. To distinguish between both units, the Blackmont unit has a LED display on the front panel, whereas the Roles does not. (Refer picture Page 2 Section 1). If unsure, then please contact your nearest Mono Pumps outlet.

1.1 INTRODUCTION

The Blackmont Muncher Control Box is designed to prevent large solids from jamming the Mono Muncher while protecting the electric motor from overloading. The Control Box is available in 1.5 kW, 2.2 kW and 4.0 kW ratings and is suitable for use with Series A, Series B and TR Munchers.

1.2 START UP PROCEDURE

1. Once the machine is installed and before power is applied to the control box, make sure all switches and circuit breakers are in the off position, and safety guards are on (the Muncher can be an extremely dangerous machine).
2. Switch on 240 v control isolator circuit breaker.
3. Switch on Muncher isolator switch.
4. Switch mode selector to auto (Muncher should start in normal running mode).
5. On start up, check direction of rotation (cutters should rotate towards centre when viewed from inlet side). If they rotate the wrong way, stop and correct the wiring.

1.2.1 OPERATION

The main electronic components in the Muncher Control Box are the thermal overload, the electrical contactors, the electronic load sensor and the logic controller.

The electronic load sensor monitors the motor load by measuring the current flowing through two phases of the electrical supply. Because the current is measured through two phases, the controller is able to provide loss of phase protection for the electric motor.

The electronic load sensor is calibrated for a single trip current and duration. If the motor current exceeds the trip point (65% of the locked rotor current) for longer than the duration time setting (1.5 seconds), the logic controller will switch the Muncher into reverse. The duration of the reverse cycle is set such that the Muncher completes one revolution. This provides sufficient time for the Muncher to clear the blockage without causing rags to be drawn around the outside of the cutter stack.

The logic controller will allow the Muncher to reverse three times within a 30-second period. If the Muncher has not cleared after three attempts, the alarm will be triggered and the Muncher will cut out.

The Muncher will stop in the reversed position, so that any obstruction can be cleared. LED's indicate the number of reverses that have occurred within the 30-second period.

The thermal overload, which forms part of the main isolator, provides a secondary backup to the current sensor and logic controller. If a condition occurs that does not trigger the current sensor, or if an electronic fault occurs in the controller the thermal overload will trip, protecting the electric motor from damage. In this situation the Muncher will not reverse and the unit would require manual resetting.

Muncher Control Enclosure
Shown with optional visual alarm fitted.

1.3 STANDARD FEATURES

- Metal power coated enclosure rated at IP55
- Dead front escutcheon type installation
- Isolator and overload protection
- 240 Volt control isolator circuit breaker
- Forward and reverse contactorswith electrical and mechanical interlocks
- Power on indicator
- Overload indicator
- Run indicator
- Electronic load sensor
- Logic controller for auto reverse
- LED display of overload reversal status
- Reset button
- Mode selector switch (auto, off, manual)
- Forward and reverse switch (for manual mode only)
- Neutral and earth bars

1.4 OPTIONS

- Interlocked main isolator switch
- Amp meter
- Hour meter
- Visual alarm fitted on the top of the enclosure with alarm test button
- Audio and visual alarm with alarm test button
- 900 mm galvanised pedestal
- 24 volt float control (2 float system)
- Metal enclosure to IP 66
- Polyester enclosure to IP 55.

1.5 MUNCHER CONTROL PART NUMBERS

Feature	Description	Coding									
		1	2	3	4	5	6	7	8	9	10
Controller	Prefix	M	U	N	-						
Power Rating	1.5 kW					Q					
	2.2 kW					R					
	4.0 kW					S					
Enclosure	Metal IP55						S				
	Metal IP66						T				
	Polyester IP55						P				
Isolator	Standard							A			
	Interlocked Main Isolator							B			
	Pedestal							C			
	Interlocked Isolator & Pedestal							D			
Power Supply	415 Volt, 3 Phase, 50 Hz								A		
	240 Volt, 1 Phase, 50 Hz								B		
	440 Volt, 3 Phase, 50 Hz								C		
	480 Volt, 3 Phase, 60 Hz								D		
Meters	Amp Meter									A	
	Hour Run Meter									B	
	Ammeter and Hour Run Meter									C	
Alarms	Visual Alarm										A
	Audio and Visual Alarm										B
	Float Control										C
	Float Control, Audio and Visual Alarms										D

1.6 OPERATION FEATURES

In Manual Mode

The motor can be manually run forward or reverse only in manual mode by use of the spring return mode selector and will still be protected against short circuit and overloading.

In Auto Mode

Motor will run automatically forward until a jammed situation occurs and will then reverse up to 3 times. If it has not cleared the controller will lock out the operation of the motor, and the system will go into alarm mode. If Muncher clears after 1st, or 2nd or 3rd overloading, it will automatically clear its memory after 30 seconds and continue in normal running mode with green LED indicator ON. Motor is also protected against short circuit and overloading.

In a totally jammed situation, the Muncher will always stop in open position to enable removal of solids.

Overload Protection

Overload protection on KTA3-25, motor protection circuit breaker, is factory set and sealed for normal temperature of 20°C. If control box is installed in places where temperatures are higher than 40°C, the adjustment should be made to a higher setting accordingly.

Calibration of the Load Sensor

The load sensor is factory set and sealed according to the size of motor nominated. Calibration is done with two pots located on the electric load sensor BEOCR-240-1M.

POT-1 sets the time from 1.5-2 seconds.

POT-2 sets the amps to 65% of the locked rotor current or 4 to 5 times the free running current.

1.7 INSTALLATION

The Muncher control box must be installed to comply with local electricity authority regulation and must be wired by a qualified electrician only. All wiring from the control box and supply must have the correct size conductor as determined by size of the motor and local electricity authorities.

Wiring from the load sensor BEOCR-240-1M to the logic controller BLC-240-1M must be kept as short as possible and away from any 415 v wiring to prevent the unit being triggered by electrical noises. In the event of such a malfunction Mono Pumps will not be liable for any damages incurred.

1.8 MAINTENANCE

The control box has been designed to reduce maintenance to a minimum. The only moving parts are contactors and relays. If the panel is installed in a dusty or corrosive environment, the control panel should be checked on a yearly basis and components changed as required.

If the motor has been in a short circuit situation, check the contactors for sticky contacts and the mechanical interlock. This should be done by a qualified electrician.

1.9 START UP PROCEDURE

Operation in Jammed situation

1. If Muncher jams it will automatically reverse one full turn and then start forward again and will be registered one clearing attempt on logic unit as OL1. If Muncher has been cleared it will proceed in normal operation and the OL1 LED will reset back to the green run LED after approximately 30 seconds.

2. If the Muncher has not cleared after the third attempt it will go into alarm mode, the alarm LED will show and the Muncher will cut out.

3. To restart the Muncher, switch the mode selector switch to manual and manually reverse and forward a few times until the Muncher becomes free.

4. Then switch mode switch to auto and reset the small reset push button on BLC-240-1M logic controller.

5. If Muncher is clear the system will resume in normal operation. (Resetting can also be achieved by switching the isolator control circuit breaker (240 v) off and on again).

6. If the controller continues to show a jammed situation but no blockage is apparent then check your power supply and wiring to motor. Test motor for faults.

Fault Situation (Motor will not run)

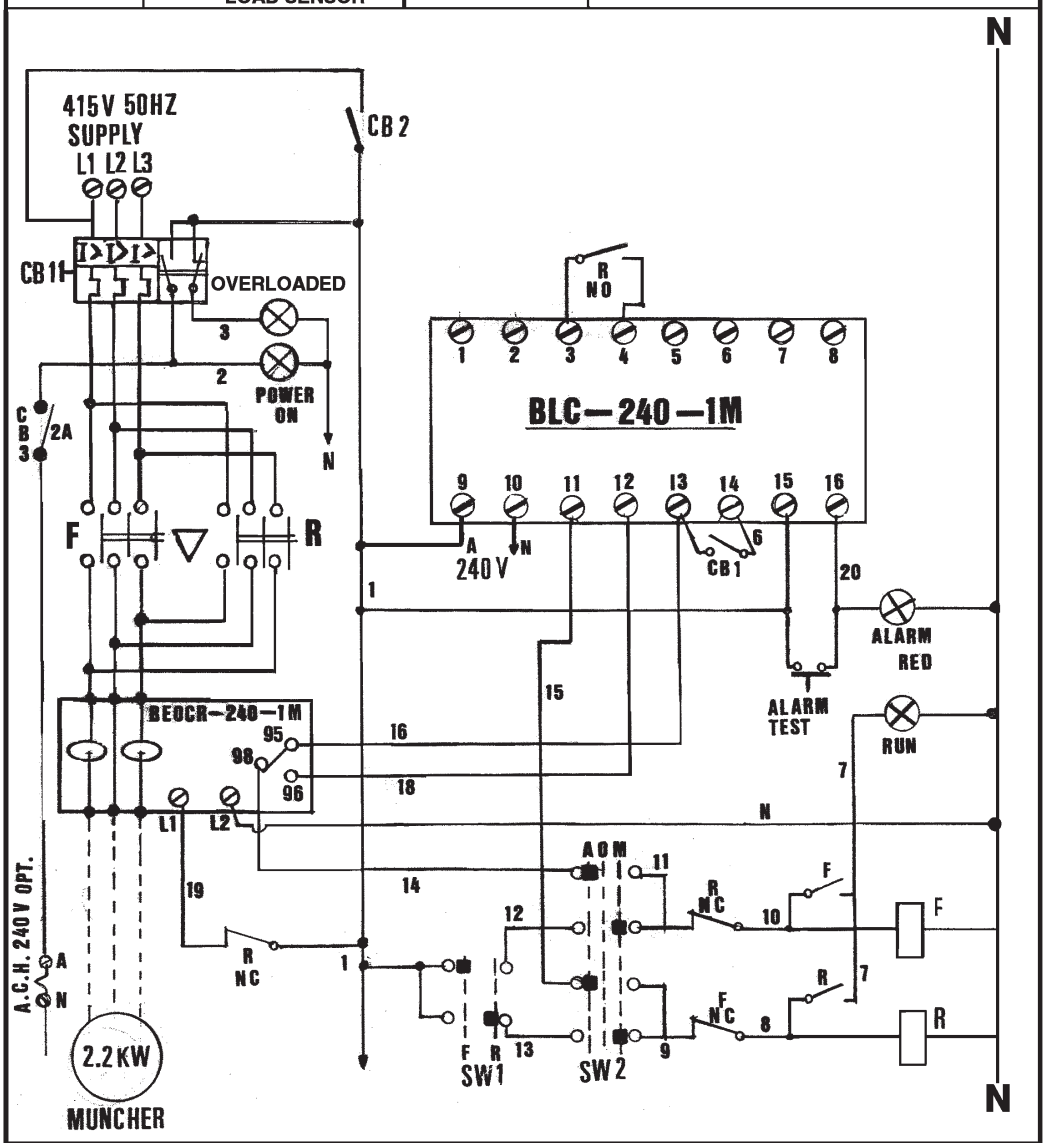
1. Check power supply.
2. Check Muncher and control isolators are ON (power control light will be on).
3. Check that mode selector is in AUTO position.
4. Push small Reset button on logic controller.
5. Check motor.

1.10 SPARE PARTS LIST

Part	Cat. No.	Maker (Supplier)
MCS Motor Protection Circuit breakers 3 pole	KTA3-25	Sprecher and Schuh (NHP)
Auxiliary Block	KT3-25-PA-11	Sprecher and Schuh (NHP)
Auxiliary Block	KT3-25-PE1-10	Sprecher and Schuh (NHP)
Control C/Breackers 1 Pole	4CB102/10	Clipsal
Pilot Lights	DLR-GRYW-CM	NHP
Selector Switch Auto-Off-Man	DSK3P-D-10/10M	NHP
Selector Switch Fwd-Off-Rev	DSK3P-D-10/10E	NHP
Pushbutton	DT3P-MB-149-10M	NHP
Contactor	6C9/01/240	Clipsal
Mechanical Interlock	6CLK38	Clipsal
Auxiliary contacts	6CA11	Clipsal
Logic controller	BLC-240-1M	Blackmont Electrics P/L
Electronic Load sensor	BEOCR-240-1M	Blackmont Electrics P/L
Alarm light	TK 86 HP 240V	Blackmont Electrics P/L
Enclosure	53018	Sarel (NHP)

1.11 WIRING DIAGRAM

CB1	NHP KTA3-25 - 6.3A C/BREAKER & O/LOAD	BLC - 240 - 1M	MUNCHER LOGIC CONTROLLER 240 V 50 H
CB2	CONTROL C/BREAKER	SW1	FWD - REV MANUAL CONTROL SWITCH
BE0CR-24-1M	ELECTRONIC LOAD SENSOR	SW2	AUTO - OFF - MANUAL SELECTOR SWITCH



NOTES	DRAWN JB	BLACKMONT ELECTRICS PTY LTD (03) 9580 0010		
	CHECKED			
	DATE 1—3—97	TITLE MONO MUNCHER CONTROL CIRUIT		
	SCALE NTS			
REVISION		APPROVED JD	DRAWING No. BMM—9701—1M	A4
REVISION		DATE 15—3—97		

2.1 INTRODUCTION

The Roles Muncher Control System has been designed to control "muncher" sludge processing equipment.

Control is achieved by monitoring motor current, line voltage and various associated control states and then controlling the motor contactors through output relays to start, stop and reverse functions of the motor. Outputs are also available to indicate motor running, overload trip and under voltage trip conditions.

2.2 START UP PROCEDURE

1. Once the machine is installed and before power is applied to the control box, make sure all switches and circuit breakers are in the off position, and safety guards are on (the Muncher can be an extremely dangerous machine).
2. Switch on 240 v control isolator circuit breaker.
3. Switch on Muncher isolator switch.
4. Switch mode selector to auto (Muncher should start in normal running mode).
5. On start up, check direction of rotation (cutters should rotate towards centre when viewed from inlet side). If they rotate the wrong way, stop and correct the wiring.

2.2.1 OPERATION

Manual Mode.

In all situations, starting of the motor is only enabled if the stop circuit is closed or deactivated.

The start circuit is closed momentarily and the forward relay will close, causing the motor to run forward. The run relay will also close indicating that the motor is running. Under normal circumstances the motor will continue to run forward until either the reverse circuit is closed or activated, the stop circuit is opened or activated, or a fault condition occurs.

Should the reverse circuit be closed, the forward relay will open and after a short time delay (to allow the contactors to operate and the motor to slow down), the reverse relay will energise. Once the reverse circuit is opened again the reverse relay will open and after a short delay, the forward relay will re-energise.

The motor will run in reverse any time the reverse circuit is closed with the stop circuit closed. The motor will continue to run in reverse as long as the reverse circuit is closed.

Should the stop circuit open, the motor will stop and the run relay will open. This stop circuit should be used as a master inhibit facility in a local/remote control station situation to prevent inadvertent starting of the motor in a maintenance situation.

A fault condition can occur in three ways; a timed overload can occur, a gross overload can occur, or an under voltage trip can occur.

A timed overload will occur if the motor current exceeds 150% full load current for a preset time according to the curves shown in Diagram 2.8. As the curves show, there is a time - current relationship built into the system with three curves available with maximum values of 150%, 300% and 400% of full load current. The time indicated on the lower axis in seconds is the time, at the current indicated, that the fault will be tolerated before a fault is indicated. Should the fault current persist for the time indicated, the system will cause the forward relay to open and the reverse relay to close. This will drive the motor in reverse to try and clear the blockage which is causing the high motor current. After the time delay preset on the reverse time switch, the reverse relay will open and the forward relay will close again. Should the fault condition persist after this operation, the whole cycle will repeat until the number of cycles preset on the fault cycles switch is reached. At this point, the system

will latch into the stop mode, opening the forward and run relays, lighting the yellow max. cycle trip LED and closing the overload trip relay. This condition can only be reset by opening the stop circuit.

A gross overload will occur if the motor current exceeds the value selected on the preset switches. That is if 300% is selected, should the motor current exceed this value, the forward and run relays will be opened, the red overload LED will light, and the overload trip relay will close. Again this condition can only be reset by opening the stop circuit.

An under voltage trip will occur if the supply voltage falls below the level set on the volt sense level preset switch. Should this occur the system will again latch into stop mode with the forward and run relays open, and the under voltage trip relay will be closed. Again this condition is only reset by opening the stop circuit.

Automatic Mode.

The Automatic Mode differs from the Manual Mode only in the fact that the Level Switch is used to control the start/stop functions of the motor.

A presettable delay is built into the system for both the switch-on and switch-off functions of the level switch. (The same delayapplies to both on and off functions). This facility allows the level switch to be used for level detection in unstable situations such as a tank with surface disturbances. The delay is such that the switch has to be on for at least the delay time for the motor to start and then it has to be off for this time for the motor to stop.

In this mode, as in all other cases, the motor will stop if the stop circuit is opened, however in this case if the level switch is still on the motor will restart (after the time delay) if the stop circuit is reclosed. Hence during maintenance, the Auto-Off-Manual switch should be set to "off" to prevent the motor from starting inadvertently.

2.3 CALIBRATION

The input calibration is performed with the stop circuit closed but without the motor running, that is with the Auto - Off - Manual switch in the manual position without closing the start circuit.

Ideally the calibration should be performed by the manufacturer with the purpose built Test Unit, however a field calibration can be achieved using a meter to measure the current either in the motor, or in the current transformer secondary.

A current should be established so that the input to the current transformer terminals is equivalent to the full load current set on positions 1, 2 or 3 of the setup switch. Hence if a 2.2 kw motor is being used with a full load current of 5.8 Amps, then for 150% set on the setup switch, a current of 5.8 x 150/100 = 8.7 Amps should be applied to the primary of the current transformer, or the equivalent (considering the ratio of the current transformer) applied directly to the "CT" terminals of the circuit board. (Maximum of 40mA can be applied to the "CT" terminals).

With this current applied press the select calibrate switch and observe the three overload LEDs on the circuit board. Using a small screwdriver adjust the calibrate input potentiometer until all three LEDs are flickering. It will be noticed that the two outer LEDs indicate the progress of the calibration, should the level be too low, the greed LED will be on, and should the level be too high the RED will be on. When all three LEDs are flickering the calibration is set for the applied equivalent current at that percentage setting. Should the setting be changed, or a different motor or current transformer be used, then the calibration procedure will have to be repeated with the changed current parameters substituted. With the calibration complete, release the select calibrate push button to resume normal operation of the system.

2.4 POWER SUPPLY

Power is supplied to the circuit board via the power contacts on the input connector (X1). The power can be anywhere within 15 - 35 volts AC or DC.

It should be noted that the power supply is monitored for under voltage to the motor and hence should be derived off a circuit intimately involved with the motor, preferably it should be from a transformer across two of the phases of the supply to the motor.

2.5 CONTROL INPUTS

The input arrangement is versatile and can be used with

multiple remote stations in various fail-safe modes with master / slave(s) style configurations.

The input controls are outlined below:

Current Transformer.

The current transformer input accepts a nominal 10m Amp outlet current transformer secondary which is set into the circuit to monitor the load current of the motor. Calibration of this input is carried out on board and is described in Section 2.3 Calibration.

Level Switch.

The level switch input accepts a set of normally open dry contacts from a level switch or similar device to start and stop the motor in the Automatic Mode. There is a selectable delay built in to the operation of the switch, both in the on and off condition. That is, the motor will only start after the selected delay time has elapsed upon the closure of the switch, and will then stop only after the same delay on the opening of the switch. It is intended that this switch be set up to monitor tank levels or such associated with the muncher so that operation is dependant on tank level. The delay is provided to allow for unstable surface conditions in the tank.

Manual / Auto Mode Switch.

The auto / manual switch determines whether the level switch (auto) or start and stop switches (manual) are going to be used to control the operation of the motor. The operation of the switch is in fact Auto - Off - Manual where one element of the three position switch is wired through the stop circuit to act as a fail-safe master switch on both the local and remote operator station(s).

A facility is provided in the setup switches on the circuit board to default the auto/manual section of the switching to either automatic or manual control. The result of this is that if the selection switch is set on (auto default), then the operation defaults to automatic if ambiguity exists in the setting of the master/slave(s) Auto - Off - Manual switches. This ambiguity only applies to the auto and manual positions of the switches because the off position is monitored through a series, normally closed stop circuit for safety reasons. Hence if any switch is set to off in the circuit, the motor will not start. However if in (say) a two station master/slave situation, one switch is set to auto and the other switch is set to manual, then with the on-board selection switch on (auto), the operation will default to auto mode. Conversely if the on-board selection switch is set off (manual) then the default mode under these circumstances would be to manual. The auto and manual circuits are independent, however at least one of these needs to be closed for the motor to start.

Start Switch.

The start switch circuit is normally open, close to latch a start and run operation, and will only be in operation in the manual mode. Any number of switches can be connected in parallel across this circuit to affect a start operation provided the stop circuit is closed.

Stop Switch.

The stop switch circuit is normally closed, open to stop or inhibit starting. This circuit operates in both the manual and automatic modes and is required to be closed for any operation to take place. As described earlier, in the Auto - Off - Manual switch, one section of the switch should be connected in series in the stop circuit to be open in the Off position to ensure fail safe operation and master / slave operator protection. Any number of normally closed (push off) switches can be incorporated in series around the stop circuit so that any switch being open will either stop the motor or inhibit its starting.

Opening the stop circuit also resets any fault condition if this should occur.

Reverse Switch.

The reverse switch circuit is normally open, close to affect a momentary reverse operation.

The operation of this circuit is such that at any time while the motor is running (unless already in reverse as a result of an overload condition) by closing the reverse circuit the forward relay will open and after a short time delay the reverse relay will close. The reverse relay will remain closed whenever the reverse switch circuit is closed, once open, the reverse relay will open and after a short delay, the forward relay will again close. These operations are again dependant on the stop circuit remaining closed.

Should the motor not be running and the reverse switch circuit is closed, while the stop circuit is closed, the reverse relay will close immediately and remain closed for as long as the reverse circuit is closed. Thus the motor can be reversed at any time provided the stop circuit is closed.

2.6 ON-BOARD CONTROLS

The on-board controls are used to setup options and calibrate the current transformer input.

Options.

The eight way dual-in-line (DIL) setup switch package has four sections used.

Switch position eight is used to set the auto/manual default mode as described previously.

Switch positions one - three are used to set up the percentage overload curve required. Only one of these switches should be on at any time, otherwise a fault condition will be signalled by flashing the three indicator Light Emitting Diodes (LED's).

The three possible selections here (150%, 300%, 400%) refer to the percentage overload tolerated before a gross overload is indicated. Within these overload bands there is a time current relationship according to the curves of Diagram 2.8, where a given overload condition will be tolerated for a specified time before an overload fault is registered. The actual values of current associated with these settings are determined by the ratio of the current transformer used and the calibration of the input circuit.

Level Switch Dwell Time.

This switch is used to set the required dwell time between when the level switch is closed (or opened) and when the circuit responds by starting (or stopping) the motor. The figures on the body of the switch represent whole seconds, hence the range is between zero and ten seconds.

Reverse Time.

This switch is used to set the motor reverse time required during the fault condition.

When an overload fault is determined, the motor will reverse for the time set on this switch. The figures on the body of the switch represent whole seconds, hence the range is between zero and ten seconds.

Volt Sense Level.
This switch is used to set the point at which an under voltage fault is triggered.

The calibration is in 5% steps referenced to a 35 volt supply input. Hence "9" represents 95% of 35 volts, or 33.25 volts at the input and so on down to 50% at "0" or 17.5 volts at the input in 1.75 volt steps.

Hence if this switch is set to "0" when the input supply voltage falls below 17.5 volts, an under volt trip will occur, stopping the motor, lighting the appropriate LED and energising the "under voltage" relay.

Fault Cycles.
This switch is used to set the required number of fault (reversing) cycles before a "maximum cycle trip" will occur. The figures on the switch body represent fault cycles, hence the range is between zero and ten cycles.

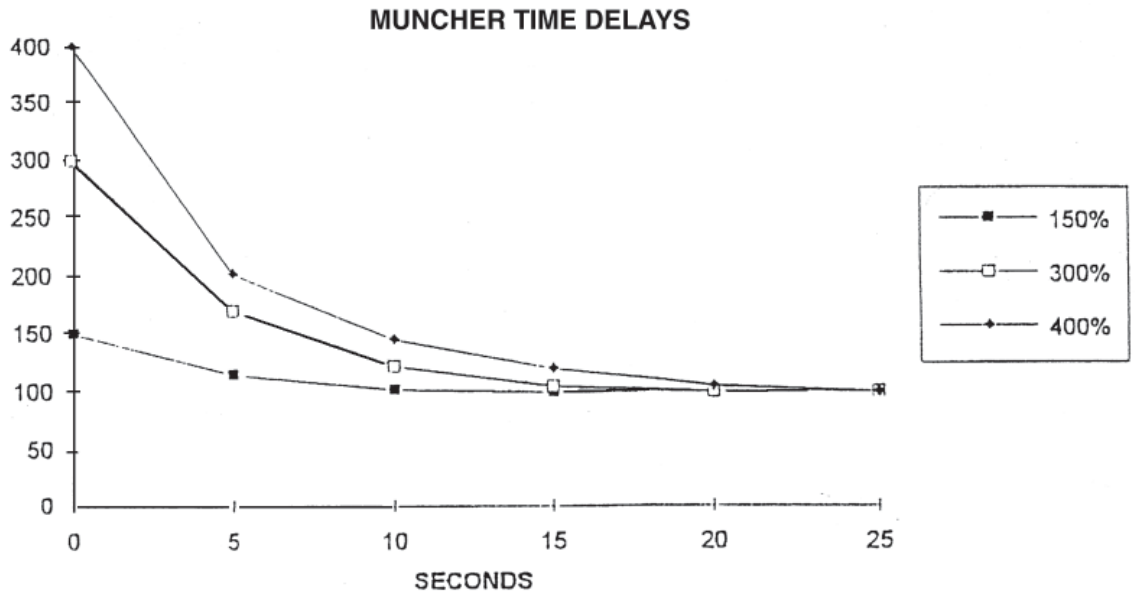
Select Calibrate Switch.
This switch is used in the calibration procedure 2.3.

Calibrate Input Potentiometer.
This again is used in calibration procedure.

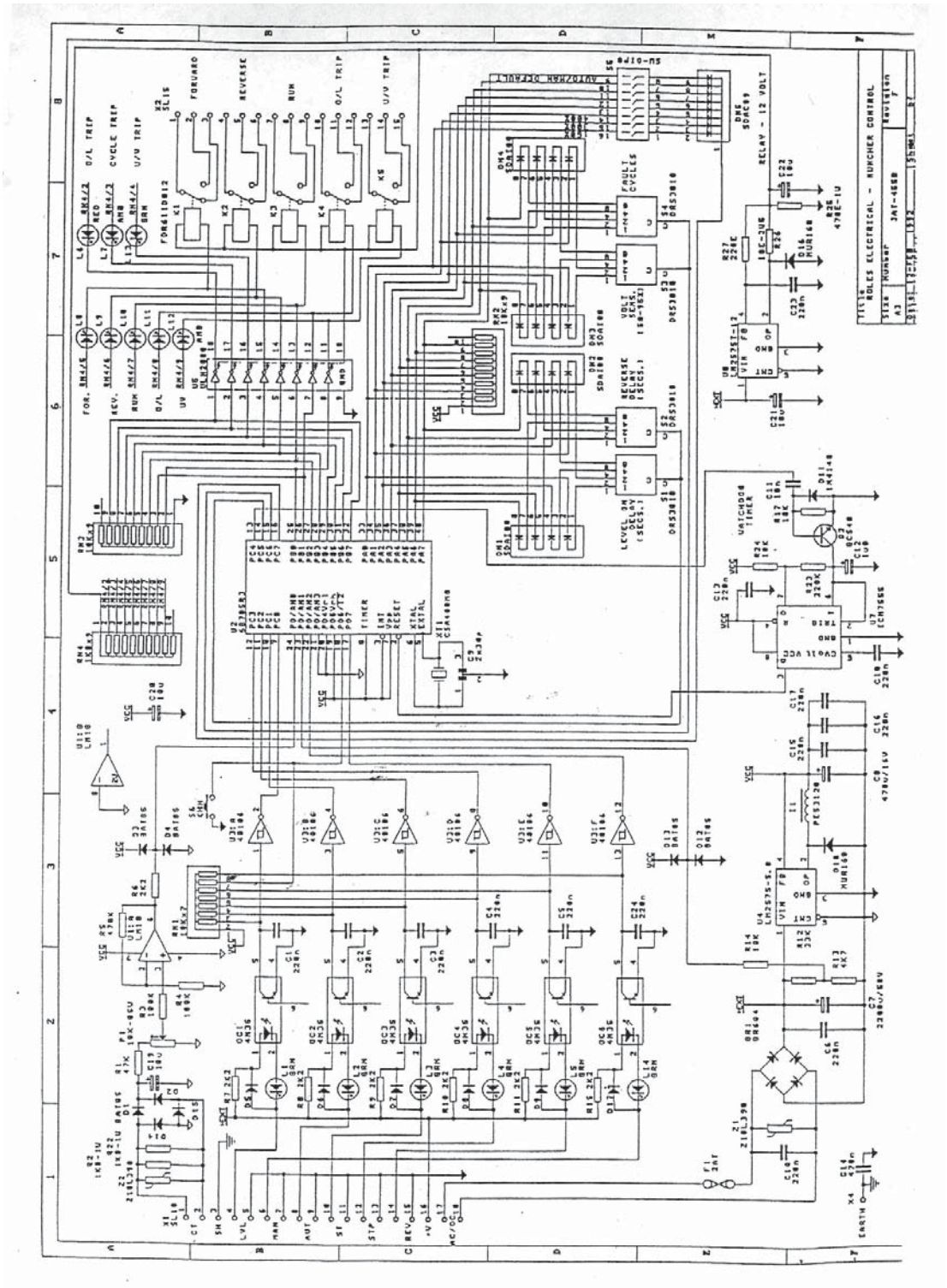
2.7 OUTPUTS

The relay outputs are dry contact Form A (changeover) rated 50 volts AC/DC at 5 amps, they are NOT rated for 240 volt operation and are NOT meant to be used to control motors directly. Intervening contactors or suitably rated relays should be used to control the motor(s) and / or ancillary equipment.

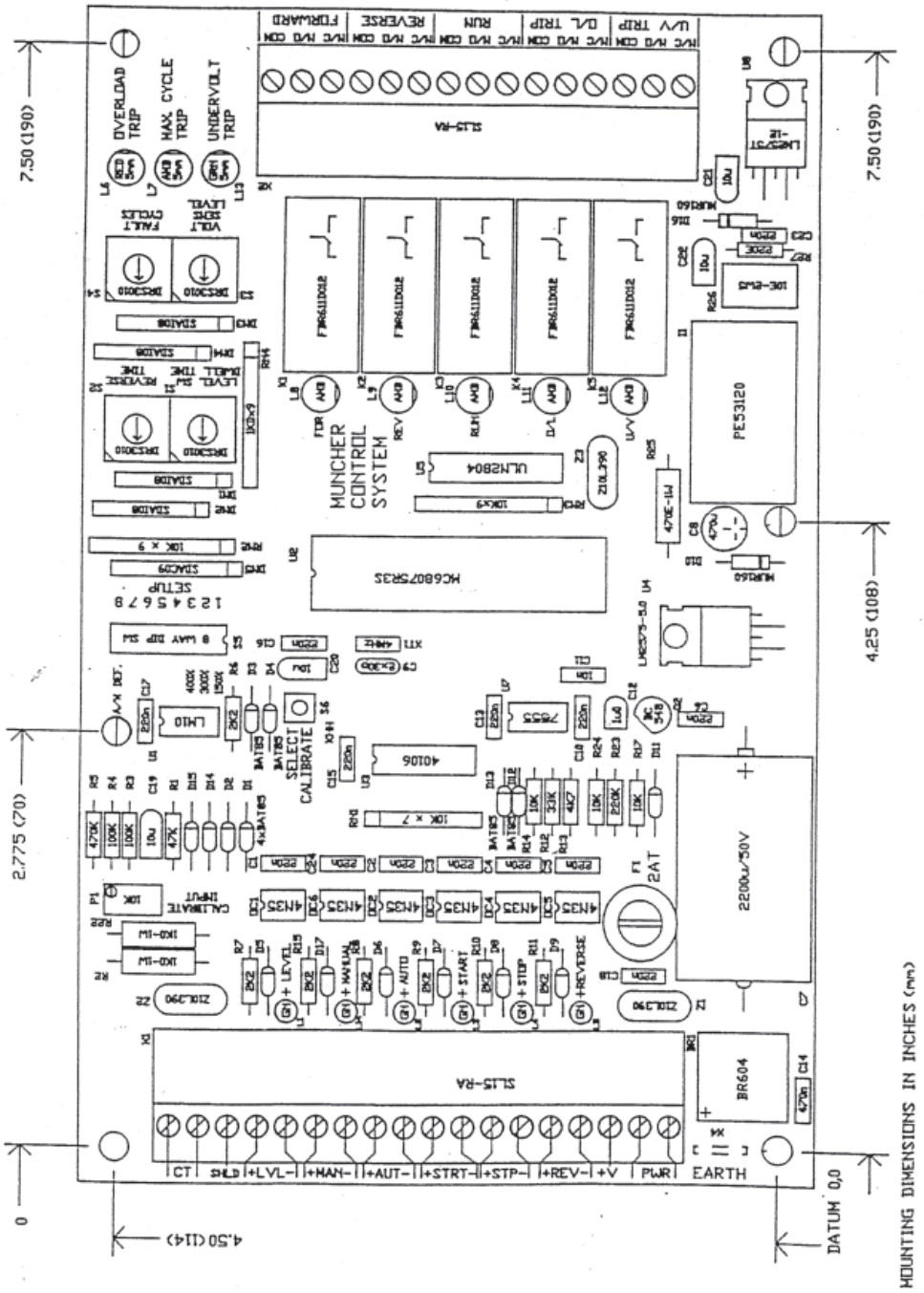
2.8 DIAGRAMS


MUNCHER TIME DELAYS
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
SECONDS
150%
300%
400%

2.8 DIAGRAMS



2.8 DIAGRAMS


7.50 (190)
4.25 (108)
2.775 (70)
0
4.50 (114)
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OVERLOAD TRIP
MAX. CYCLE TRIP
UNDERVOLT TRIP
L.V. TRIP
O/L TRIP
RUN
REVERSE
FORWARD
MUNCHER CONTROL SYSTEM
SELECT
CALIBRATE
2AT
2200u/50V
CT
SHLD
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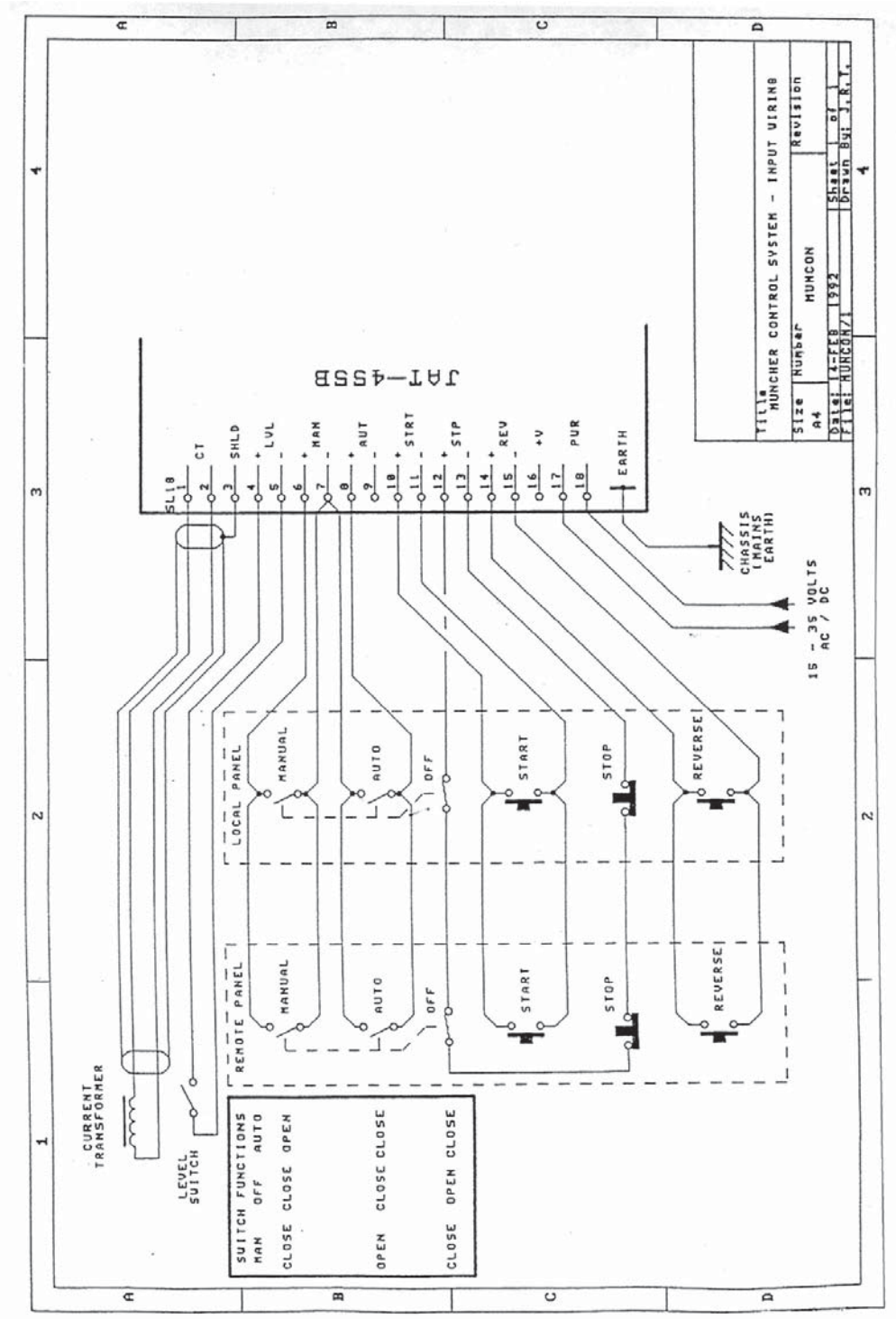
+AUT-
+STRT-
+STP-
+REV-
+V
PWR
EARTH

2.8 DIAGRAMS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CT
SHLD
LVL
MAN
AUT
STRT
STP
REV
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PUR
EARTH
CHASSIS (MAINS EARTH)
15 - 35 VOLTS AC / DC
LOCAL PANEL
REMOTE PANEL
MANUAL
AUTO
OFF
START
STOP
REVERSE
CURRENT TRANSFORMER
LEVEL SWITCH
SWITCH FUNCTIONS
MAN OFF AUTO
CLOSE CLOSE OPEN
OPEN CLOSE CLOSE
CLOSE OPEN CLOSE
MUNCHER CONTROL SYSTEM - INPUT WIRING
Size A4
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Revision
Date: 14-FEB 1992
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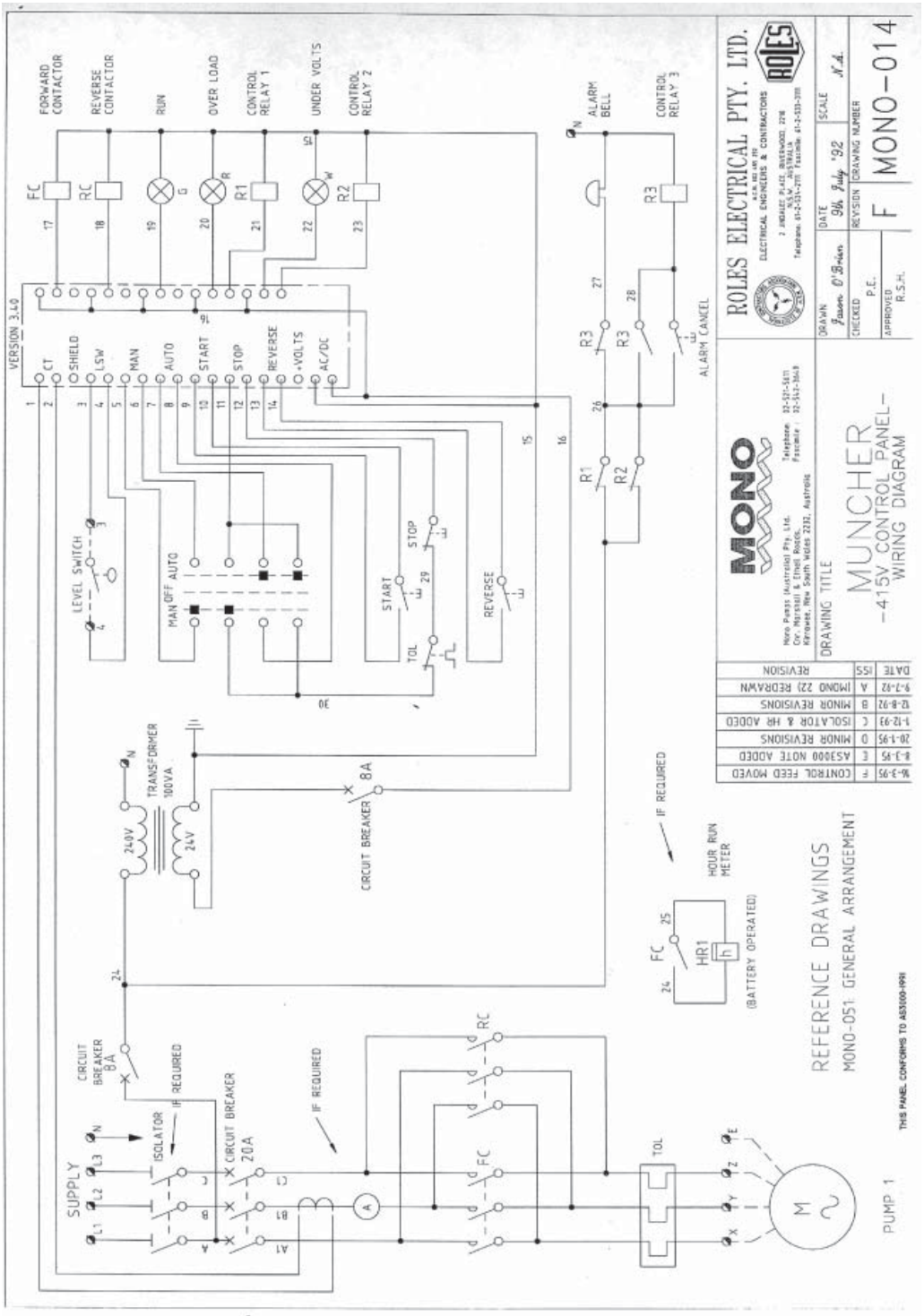
2.8 DIAGRAMS


ROLES ELECTRICAL PTY. LTD.
MONO-014
MUNCHER
-415V CONTROL PANEL-
WIRING DIAGRAM
REFERENCE DRAWINGS
MONO-051 GENERAL ARRANGEMENT
FORWARD CONTACTOR
REVERSE CONTACTOR
RUN
OVER LOAD
CONTROL RELAY 1
UNDER VOLTS
CONTROL RELAY 2
ALARM BELL
CONTROL RELAY 3
LEVEL SWITCH
MAN OFF AUTO
START
STOP
REVERSE
TOL
TRANSFORMER 100VA
240V
24V
CIRCUIT BREAKER 8A
CIRCUIT BREAKER 20A
ISOLATOR
IF REQUIRED
HOUR RUN METER
(BATTERY OPERATED)
ALARM CANCEL
SUPPLY
PUMP 1
THIS PANEL CONFORMS TO AS3000-1991

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Brisbane	T.	07 3350 4582	F.	07 3350 3750
Adelaide	T.	08 8447 8333	F.	08 8447 8373
Perth	T.	08 9303 0444	F.	08 9303 4430
Darwin	T.	08 8931 3300	F.	08 8931 3200
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