Installation, Operation & Maintenance Instructions for

Braketronic Electronic Controls

Variable Torque Control for Electro-Hydraulic Brakes

CONTROLLER SERIAL NO:
CONTROLLER ELECTRICAL SUPPLY:
CONTROLLER OUTPUT:
FOR USE WITH BRAKE(S):
SUPPLEMENTS FORMING PART OF THIS MANUAL:
DATE OF MANUFACTURE:
CONTROLLER OUTLINE DRAWING:
EXTERNAL WIRING DIAGRAM:
INTERNAL WIRING DIAGRAM:
PARAMETER SETTINGS:

Read and Understand All Warnings and Notices Printed In this Manual and the Brake Manual Before Commencing Installation, Adjustment or Repair

1.0: Table of Contents

2.0: General Description

2.1: The Braketronic system provides a means of varying the braking torque developed by Mondel spring applied, thruster released, shoe and disk brakes.

2.2: Single, or multiple, brakes may be operated in parallel from one Braketronic controller.

2.3: Braking torque modulation, between zero and maximum, is achieved by either of the two following methods:

2.3.(a) : Continuous variation controlled by external means, (usually a pedal operated module).

2.3.(b) : Preset rate variation controlled by an internally generated ramp signal.

2.4: Control of torque is achieved by modulating the electrical supply voltage and frequency to the thruster pump motor. This varies the speed of the pump impeller and thus the pressure and volume of hydraulic fluid delivered to the thruster piston.

2.5: The thruster piston extends offsetting the torque spring force applied to the brake shoes as follows:

2.5.(a) : Maximum frequency & voltage supplied to the thruster produce full motor speed with maximum pump output. Piston output will overcome torque-spring force and move the shoes away from the brake wheel; braking torque falls to zero and shoe clearance reaches its maximum.

2.5.(b) : Thruster piston output force varies with pump motor speed. As pump speed and piston force decrease, the torque-spring force available to the brake shoes increases. This allows the shoes to close on the brake wheel. Braking torque develops and increases as thruster pump output decreases further.

2.5.(c) : Maximum brake torque is generated as motor and pump speed fall to the level at which the thruster piston is no longer able to offset torque-spring force.

NOTE: Interruption of power to the thruster produces the maximum available braking torque.

2.6: When using a pedal, or similar remote control and all conditions for operation are met, the output voltage and frequency produced by the Braketronic controller will vary, depending upon the position of the pedal, as follows:

2.6.(a) : With the pedal released (OFF), the Braketronic supplies rated voltage and frequency to the thruster motor. The motor will run at its rated RPM to fully release the brake.

2.6.(b) : When foot pressure is applied to the pedal, an internal switch trips soon after the pedal leaves the released (OFF) position. This switch signal causes the controller output to decrease, at a preset ramp rate, quickly moving the shoes into light “kiss” contact with the brake wheel.

2.6.(c) : As pressure on the pedal increases a potentiometer, arranged to sense pedal position, adjusts the controller setpoint causing its output to decrease and produce a gradual increase in braking torque.

2.6.(d) : When the pedal is fully depressed, the controller output continues to decrease to the point where the thruster is unable to offset any torque spring force and maximum braking torque is produced.

2.6.(e) : A small decrease in pedal pressure changes the position of the controller setpoint potentiometer, producing an increase in controller output which increases the thruster motor RPM. The thruster motor speed increase acts to offset torque spring force and decrease the braking torque.

2.6.(f) : When pressure on the foot pedal is completely removed, the internal switch resets to produce maximum controller output and quickly move the shoes clear of the wheel.

Note: When circumstances permit, ramp rate parameters are factory set for operation with a specified brake, or brakes. However, a digital operator is supplied with each Braketronic controller to allow on-site modification of any parameter. Contact the factory for instructions.

2.7: **"Wireless Remote Control"**, (supplied by others), can be used to regulate the output of a Braketronic controller. Braking characteristics are similar to those afforded by the pedal operator while allowing the operator considerable mobility. Operation is generally as follows:

2.7.(a) : When the wireless "Brake Master Switch is not operated, the Braketronic unit supplies rated voltage and frequency to the thruster motor, and fully releases the brake.

2.7.(b) : Initial movement of the "Brake Master Switch" activates a primary relay. This sets the controller output to a value that quickly moves the shoes into light "kiss" contact with the brake wheel.

2.7.(c) : Advancing the "Brake Master Switch" to nearly full travel, produces a continued, but slower, decrease in controller output with a corresponding increase in brake torque.

2.7.(d) : When the "Brake Master Switch" reaches full travel, controller output continues to decrease to the point where the thruster is unable to offset any torque spring force and maximum braking torque is produced.

2.7.(e) : Gradually allowing the "Brake Master Switch" to return to its starting position increases controller output and thruster motor RPM. The thruster motor speed increase acts to offset torque spring force and decrease the braking torque.

2.7.(f) : When the "Brake Master Switch" returns to its starting position, the primary relay releases to produce maximum controller output and quickly move the shoes clear of the wheel.

2.8: Pre-programmed **"Fixed Rate Ramp Control"** is available as an alternative to variable rate braking. With "Fixed Rate Ramp Control", the controller produces an output whose voltage and frequency emulate pedal operation.

Ramp function parameters are factory preprogrammed, but can be modified on-site using the digital operator provided with each Braketronic controller.

2.8.(a) : Ramp operation is initiated by closing a voltage free contact. This causes the output frequency and voltage of the controller to decrease relatively quickly moving the shoes into light "kiss" contact with the brake wheel.

2.8.(b) : As soon as the "kiss" stage is reached, controller output decreases more slowly to produce a ramp controlled increase in braking torque. At the end of this ramp period, controller output decreases to the point where the thruster is unable to offset torque spring force to produce maximum attainable braking torque.

2.8.(c) : Opening the voltage-free contact signals the Braketronic output to increase at the predetermined ramp rate(s). The frequency and voltage will ramp to maximum and the brake will return to the fully released state. The brake will remain released until "Ramp Control"

mode is selected and the voltage free ramp initiation contact closes, or power to the Braketronic system is interrupted.

Do you require more information? Contact MONDEL at 1 800 792 7253

2.9: Controller Enclosure

2.9.(a) : The solid state drive, user terminals, fuses, circuit breakers and optional auxiliary devices such as filters, relays, selector switches and transformers are housed in a stainless steel NEMA 4 wall - mounting enclosure shown in Figure 1.

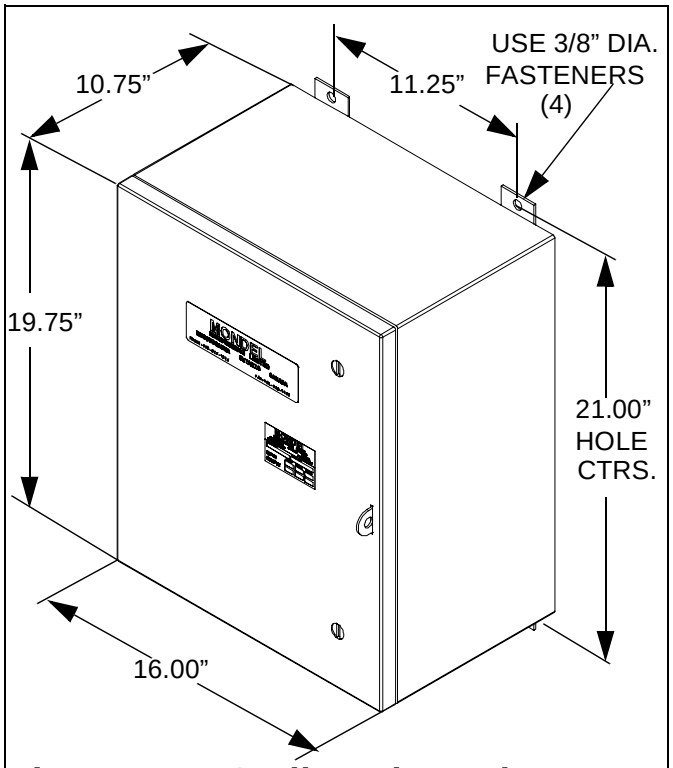

Figure 1: Outline Dimensions, Braketronic NEMA 4 Enclosure

2.10: Pedal Unit

2.10.(a): Figure 2 shows the foot pedal unit. It consists of a floor mounted, NEMA 4, cast aluminum enclosure containing 3 switches and a potentiometer. The pedal drives the potentiometer via a gear set and the switches via independently adjustable cams.

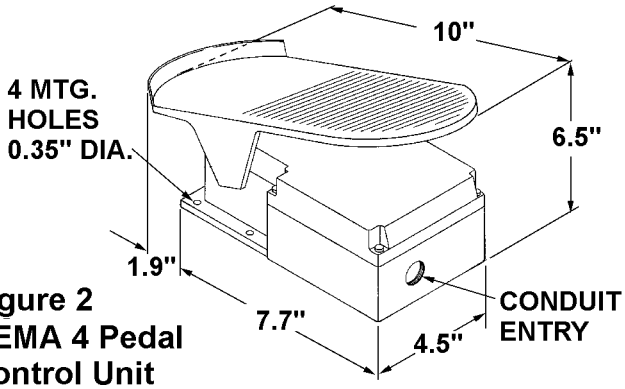

Figure 2 NEMA 4 Pedal Control Unit

3.0: Installation

Anyone involved in the installation or service of this brake and control equipment must have:-

- received specific training.
- had experience on similar equipment.
- knowledge of the equipment on which the brake is installed.
- the ability to understand the terminology.
- the ability to understand the diagrams.

Do not proceed unless technically qualified for the work involved.

CAUTION: Prior to the installation of a BRAKETRONIC system, check all technical details and compare to the rating plate data and applicable specifications.

3.0.(a) : These notes form part of the scope of supply for BRAKETRONIC systems when used with MONDEL spring applied, thruster released brakes. These notes are valid only when the equipment is installed in accordance with drawings and supporting documentation specific to the equipment.

3.0.(b) : MONDEL ENGINEERING will not be responsible for modifications made, by others, after this equipment leaves the factory, unless prior written authorization has been obtained from MONDEL ENGINEERING.

3.0.(c) : Based on data furnished to us by the purchaser or his agents, MONDEL will adjust and calibrate BRAKETRONIC controllers to suit specific brake applications

3.0.(d) : The installer is responsible for compliance with all relevant safety codes and regulations.

3.1: Locating the Braketronic Controller

3.1.(a) : Mount the controller enclosure with the hinge vertical to ensure the effectiveness of internal cooling fins.

3.1.(b) : Allow 4" minimum clearance all round the enclosure for ventilation. Protect from unreasonable amounts of dust, grease, liquids or gases.

3.1.(c) : Mount in a shaded location out of direct sunlight, and provide radiant heat shielding, where necessary, to protect the temperature-sensitive components.

4.0: Electrical Connections

Unexpected movement or hazardous voltage can cause injury or death. Disconnect, lock out, and tag out the power source that feeds this device to prevent power from being applied while work is carried out on the equipment.

4.0.(a) : Internal and external wiring diagrams specific to the Braketronic controller are attached, and form part of this manual. External (user) connections are shown on sheet 1 of 2; sheet 2 of 2 provides details of internal factory wiring. Diagram drawing numbers are listed on page 1 of the relevant instruction manual.

4.1: Power Supply Connections

4.1.(a) : Select appropriate conductor size, insulation, jacket and branch circuit protection in accordance with local electrical codes. Specific electrical characteristics will be found on the Braketronic controller nameplate. Connect power only to the power supply terminals as shown on the specific wiring diagram. Verify polarity when a direct current supply is specified.

4.1.(b) : Internal fuses or circuit breakers, suitable for the application, are provided at the Braketronic controller power supply input terminals. The fuse/breaker rating is shown on the specific wiring diagram.

4.1.(c) : A ground stud is provided on the subpanel to receive all connections from power line protective ground wire conductors.

4.1.(d) : External electrical wiring must be connected only at the terminal block; specific wiring diagrams will show connection details.

4.1.(e) : Conduit/cable entries must be located in the bottom face of the enclosure to minimize moisture entry. Use separate conduits for power line input, controller output and control wiring.

4.1.(f) : Ground all enclosures and components as required by local electrical codes.

Do not connect power directly to terminals T1, T2 & T3 under any circumstances. This may lead to danger to life and destruction of the device.

Hazardous voltages remain present at the terminals of the controller for as long as 3 minutes after power is interrupted! Never work on a Braketronic unit with power applied.

4.2: Power Connection To The Brake Thruster

4.2.(a) : Select appropriate conductor size, insulation and jacket in accordance with local electrical codes. Specific electrical characteristics will be found on the Thruster nameplate. Use a separate conduit to connect from the brake thruster terminals L1, L2, L3 & G to terminals T1, T2, T3 & PE on the controller. Shielded conductors are unnecessary under most conditions, however output cable runs exceeding 15 feet, require motor line reactors to

be installed. Information concerning unusual operating conditions is obtainable from the factory.

4.3: Control Connections

4.3.(a) : The control lines, (16 to 20 AWG., low voltage 0 - 5V), between the controller and the pedal unit, or any other remote control devices, must be shielded. Ground the control conductor shields only at the Braketronic terminal block as shown by wiring diagram sheet 1 of 2. Run the control wiring in a separate conduit containing no other circuits.

5.0: Operational Test

Review and verify the following checklist before switching on the power source feeding this system.

- Components are as supplied by the factory.
- Wiring is correct per relevant diagram.
- Enclosures are grounded in accordance with local electrical codes.
- Power supply is within the specified range, and the correct voltage/polarity is available at the power supply input terminals.
- Brake adjustments are complete in accordance with the relevant brake instruction manual.

Before conducting an operational test, remove all tools, chocks and other equipment which may create a hazard when the machine is operated.

In a hoist application, post observers to monitor the position of the hook if it travels out of sight of the operator.

Before attempting to operate any motion in any application, advise and account for the location and security of all personnel involved.

5.1: Comply with the owners' safety procedures and heed all warnings and notices, both in the BRAKETRONIC and BRAKE instruction manuals.

5.2: Follow all standards and local statutes.

5.3: Remove any drum chocks on a hoist application.

5.4: As a preliminary test, operate the brake system without load and proceed as follows:

5.5: Pedal Controlled Variable Torque

5.5.(a) : Switch on the power supply to the Braketronic unit. The brake must quickly release the load.

5.5.(b) : Without delay, apply light pressure to the brake pedal; the shoes should quickly move into light "kiss" contact with brake wheel.

5.5.(c) : Apply more force to the pedal; braking torque will increase as shoe pressure on the brake wheel increases.

5.5.(d) : Just before the pedal reaches its fully depressed position maximum brake shoe to wheel pressure is achieved; full torque is developed to hold the load stationary.

5.5.(e) : If the brake fails to respond as above, repair or re-adjust the brake as necessary. Visually inspect the brake during operation to ensure all adjustments are correct. If successful, continue with longer duration tests until confident that the brake and Braketronic system is operating satisfactorily. See Table 1 for the Variable Control Operating Sequence.

5.6: Ramp Controlled Torque, Optional Feature

5.6.(a) : Switch on the power supply to the Braketronic unit. The brake must quickly release the load.

5.6.(b) : Initiate the ramp signal contact; the shoes should move quickly into light "kiss" contact with brake wheel.

5.6.(c) : After the "kiss" contact stage is reached, shoe movement slows and increases pressure to the wheel; braking torque rises as shoe pressure on the brake wheel increases.

5.6.(d) : The time taken from ramp contact initiation to the development of full torque is determined by the duration of the ramp signal.

5.6.(e) : When the ramp signal duration times out, the controller output decreases to produce maximum brake shoe to wheel pressure; full torque is developed to hold the load stationary.

5.6.(f) : If the brake fails to respond as above, repair or re-adjust the brake as necessary. Visually inspect the brake during operation to ensure all adjustments are correct. If successful, continue with longer duration tests until confident that the brake and Braketronic system is operating satisfactorily. See Table 2 for the Ramp Control Operating Sequence.

Note: The 3 phase RMS output voltage, of a DC type controller, reads less than its DC voltage input.

6.0: Servicing

Before working on a Braketronic system, ensure that power has been disconnected for at least 3 minutes. Internal capacitors hold a charge and hazardous voltages remain present at terminals and components up to 3 minutes after power is turned off.

6.0.(a) : Maintain cleanliness and ensure that all covers and doors are sealed to exclude dirt.

6.0.(b) : Parameter adjustments and trouble shooting guidelines for the integral solid state drive are beyond the scope of this publication. Refer to the Technical Manual supplied with the Braketronic system for related information.

7.0: Long Term Storage

7.1: If the equipment will not be installed immediately, it can be stored indoors in a dry location indefinitely, or outdoors for a reasonable time if adequately protected from moisture and corrosive atmosphere. The equipment must always be protected from direct exposure to the elements unless specifically treated at the factory for use in that environment. Covering with plastic sheeting is not acceptable unless provision is made to prevent condensation under the plastic.

8.0: Operational Sequence Tables

Table 1: Braketronic Operating Sequence, Variable Torque Control, (Note A)

Crane Status	P.S. Line Dis-connect	Raise/ Lower Contact	P.S. to Braketronic	Crane Motor	Pedal Control	Braketronic Output frequency	Pedal Switch	Brake Function	Note
OFF	0	0	0	0	0	0	0	T = Max	(B)
STANDBY	1	0	1	0	0	0	0	T = Max	(C)
RAISE/LOWER	1	1	1	1	0	60	0	Brake Released, T = 0	(D)
APPLY BRAKE	1	1	1	1	3^0 to 5^0	60 Ramp to 40	1	Shoes Move Quickly To “Kiss” Wheel	(E)
INCR. BRAKE	1	1	1	1	95%	40 Ramp to 20	1	T Increases	(F)
MAX. BRAKE	1	1 or 0	1	1 or 0	>95%	<20	1	T = Max	(G)

Table 2: Braketronic Operating Sequence, Ramp Torque Control, (Note A)

Crane Status	P.S. Line Dis-connect	Raise/ Lower Contact	Power to Braketronic	Crane Motor	Ramp Contact	Braketronic Output frequency	Brake Function	Note
OFF	0	0	0	0	0	0	T = Max	(B)
STANDBY	1	0	1	0	0	0	T = Max	(C)
RAISE/LOWER	1	1	1	1	0	60	Brake Released, T = 0	(D)
BRAKE APPLIED	1	1	1	1	1	60 Ramp to 40	Shoes Move Quickly To “Kiss” Wheel	(H)
	1	1	1	1	1	40 Ramp to 20	T Increases	(J)
MAX. BRAKING	1	1 or 0	1	1 or 0	1	<20 Hz	T = Max	(K)

(A) Braketronic controller & brake installed in accordance with drawings & supporting documentation specific to the equipment.
(B) Line disconnect is open; power is not available to either the brake or Braketronic controller.
(C) Line disconnect is closed; power is available to both brake & Braketronic controller. Braketronic output is zero and crane is ready for operation.
(D) Raise or lower push button switch operated; Braketronic output is maximum; brake quickly releases and crane motor starts to run.
(E) Light pressure on foot pedal actuates primary switch; Braketronic output falls rapidly to appx. 40 Hz. to quickly take up clearance between shoes and brake wheel.
(F) Pressure applied to the foot pedal increases; Braketronic output frequency decreases more slowly and braking torque increases.
(G) With the foot pedal completly depressed, Braketronic output continue its decrease to the level where the thruster cannot offset the torque spring force and braking torque is the maximum attainable. NOTE: Maximum torque will stall the crane motor. The user must make provision to avoid sustained overload conditions.
(H) Ramp contact closure initiates a rapid decrease, in Braketronic output.
(J) Sustained ramp contact closure continues the decrease in Braketronic output, but at a reduced rate.
(K) The ramp output sequence is complete; Braketronic output has fallen to the point where the thruster can no longer offset torque spring force and braking torque is the maximum attainable. NOTE: Maximum torque will stall the crane motor. The user must make provision to avoid sustained overload conditions.

LEGEND:
0 indicates not-operated, zero, open or off
1 indicates operated, maximum, closed or on
T indicates Torque
P.S. indicates power supply
INCR. indicates Increase
MAX. indicates Maximum
DECR. indicates Decrease