

**INSTALLATION, OPERATING, &
MAINTENANCE MANUAL FOR
HE10:150
TRIPLE-STAGE
MAGNETIC ROLL SEPARATOR**

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• Electrical Schematic	#E000321

1 SAFETY WARNINGS



READ ALL INSTRUCTIONS. USE THIS MACHINE ONLY AS DIRECTED IN MANUAL.



ENTANGLEMENT HAZARDS: IN CASSETTES & ROLL-FEEDER MECHANISMS. NO LOOSE CLOTHING OR LONG HAIR, FINGERS, HANDS, OR ANY OTHER BODY PARTS SHALL BE CLOSE TO ANY ROTATING PART OF THE MACHINE. ALWAYS INSPECT THE SEPARATION PERFORMANCE FROM A SAFE DISTANCE.



NOTE THAT THE MAGNETIC ROLLS ARE VERY POWERFUL. DO ALLOW ANY PART OF YOUR BODY TO GET PINCHED BETWEEN THE MAGNET ROLL AND ANY TOOLS OR METAL OBJECTS.



DANGER: NEVER PLACE YOURSELF OR A PART OF YOUR BODY BETWEEN TWO MAGNETIC ROLLS. SERIOUS BODILY INJURY MAY RESULT.



EYE PROTECTION REQUIRED FOR MACHINE MAINTENANCE & OPERATION.



USER MUST CHECK FOR RESPIRATORY HAZARDS RELATING TO FEED MATERIAL AND PRODUCTS AND PROVIDE BREATHING EQUIPMENT TO OPERATORS IF NECESSARY.



CASSETTE SWING BOLT MUST BE UP AND BOLTED TO CASSETTE FORK BEFORE CASSETTE DRIVE IS OPERATED.



ALL DOORS MUST BE CLOSED FOR (NON-MAINTENANCE) MACHINE OPERATION.



HIGH VOLTAGE ELECTRICAL POWER IS PRESENT INSIDE THE CONTROLLER, JUNCTION BOX, AND MOTORS. DO NOT OPERATE MACHINE WITH ELECTRICAL PANELS OPEN. SKILLED ELECTRICIANS SHOULD PERFORM ELECTRICAL INSTALLATION IN ACCORDANCE WITH LOCAL CODES AND PRACTICES.



STAY CLEAR OF THE DISCHARGE OPENINGS UNDER THE MACHINE DURING START-UP AND OPERATION. MINERAL PRODUCTS EXIT THE MACHINE FROM THIS AREA.

2 INTRODUCTION

The Outotec® HE10 is optimized to separate fine particle minerals using high-strength Nd-Fe-B magnetic technology. On traditional rare-earth belt separators, the mineral bed has a long residence time riding on the belt towards the magnet roll; this allows triboelectric charging that can reduce separator efficiency, particularly with fine materials. On the HE10, minerals are fed directly onto the magnetic roll thus minimizing the triboelectric charging effect. Many other desirable features come standard on this separator.

The cantilever HE10 cassette design allows for rapid, one-man belt changes. The cassette also allows for optimal magnet roll alignment with the splitter blade; this alignment improves separation performance particularly on wide machines. Each cassette comes standard with a specially developed belt tracking and tensioning system and an air purge manifold to prevent dust particle entrapment.

The adjustable transition chute at the roll feeder and at each separation stage allows the feed product to be precisely and uniformly delivered to the magnet roll.

The HE10 frame, hopper, and door systems were specifically designed to contain fine particle products inside the machine. Provisions are made for per-stage dust extraction at the front of the machine above the magnet rolls and on the roll feeder; this, and the cassette air purge system, allow for belt life improvements. The carbon steel machine frame and aluminum doors are powder coated to provide a tough corrosion protection barrier. All hopper parts of the RF06 and main machine that contact the mineral stream are constructed from stainless steel.

The modular slide-in stainless-steel hopper design allows for simple in-situ machine maintenance. The entire machine (except for frame) can be disassembled in-place by two or three men without the use of an overhead crane.

The HE10 magnet roll drive system includes a shaft-mounted 5:1 gearbox with a three-phase 1/3HP inverter rated AC motor. The motor is driven from an inverter that can accept single- or three-phase customer supply voltages at 50 or 60Hz. The motor/gearbox & inverter system is normally configured to support magnet roll speeds from 35-to-525rpm; other speed ranges are available on request.

The RF06 roll feeder is driven by a shaft-mounted 80:1 gearbox with three-phase 1/3 HP inverter rated AC motor. The RF06 motor/gearbox & inverter system is normally configured to support feed roll speeds of 2.2-to-33rpm.

The standard HE10 controller comes standard with independent speed controls for the roll feeder and each cassette, E-stop & reset logic to prevent unattended restarts, circuit breaker protection of internal & external wiring, and an hour meter to monitor run-time on belts. The controller can be configured to accept low voltage inputs from 208-to-240VAC or high voltage inputs from 380-to-480VAC. Other AC input voltages can be supported. The NEMA 12 control enclosure can be wall or pedestal mounted as dictated by the installation requirements.

The HE10 machine & control system can be configured with many optional features:

- 1) Ionizer system support.
- 2) Feed material over-temperature protection system.
- 3) Belt breakage detection system.
- 4) Machine door interlock switches.
- 5) Terminals for remote control & monitoring from customer's PLC.

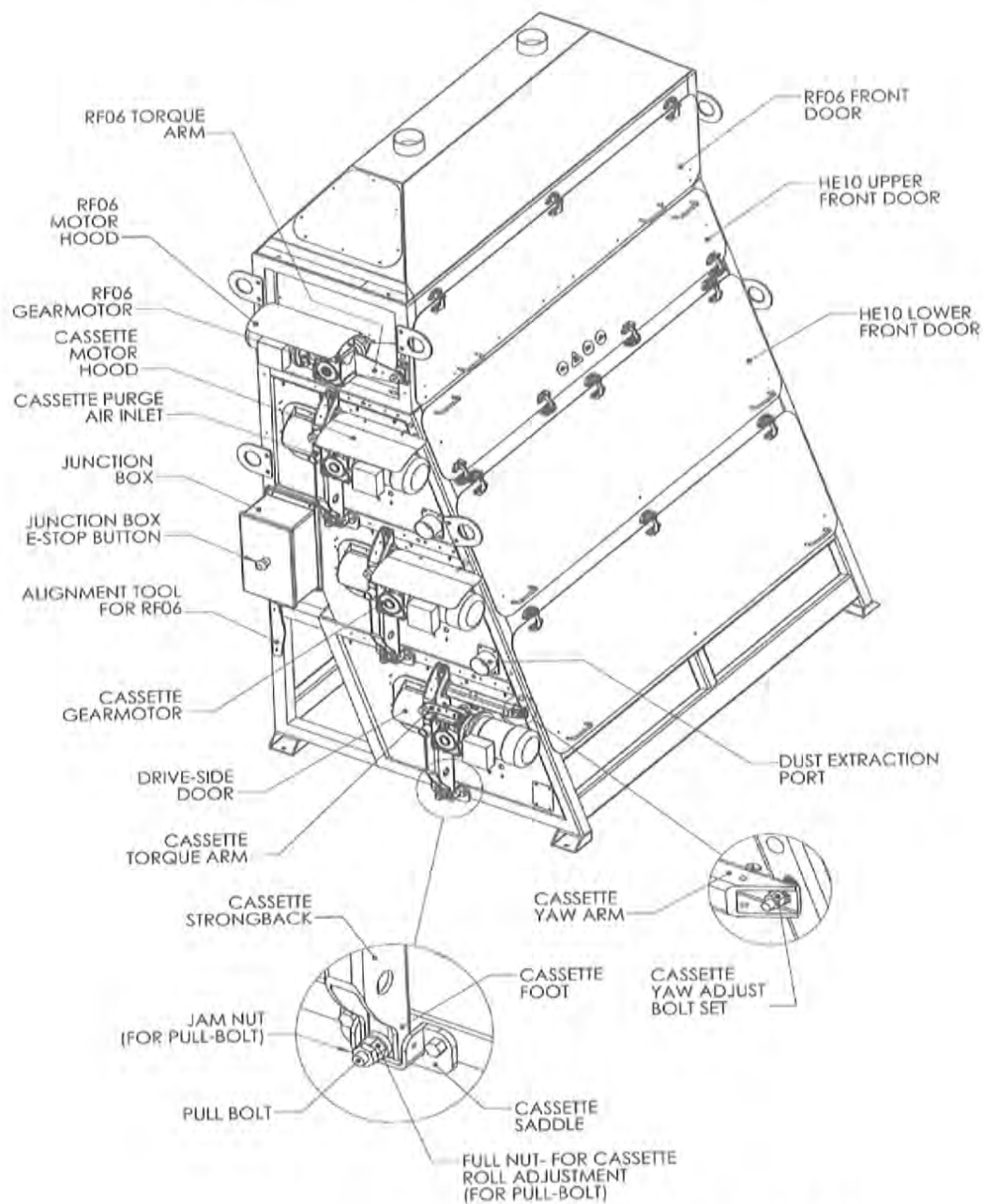


Figure 2.1 HE10 Nomenclature (Drive Side)

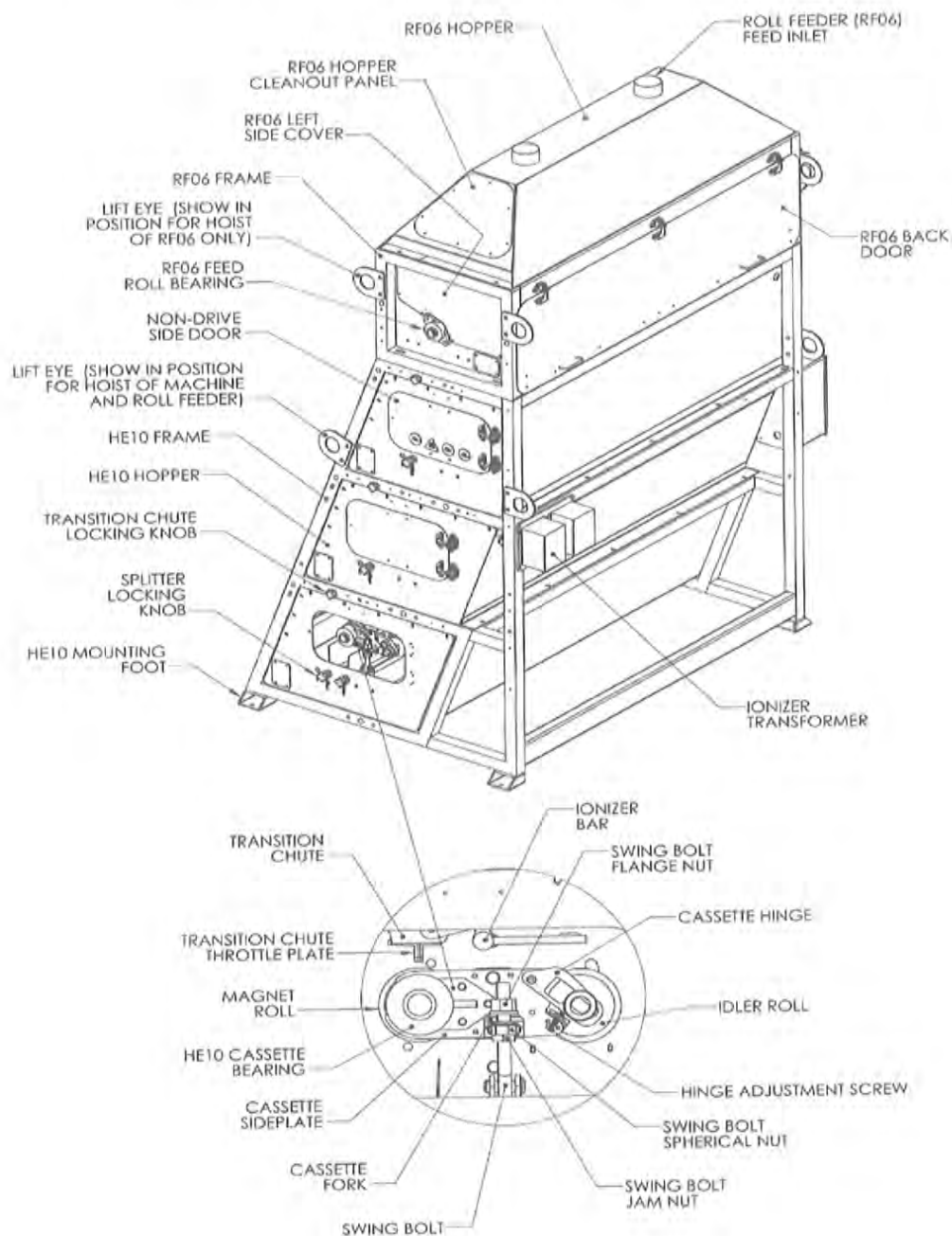


Figure 2.2 HE10 Nomenclature (Non-Drive Side)

3. INSTALLATION & START-UP PREPARATION



READ ALL SECTIONS OF THIS MANUAL BEFORE PROCEEDING!



MACHINE POWER SHOULD BE DISCONNECTED BEFORE MECHANICAL HANDLING/ASSEMBLY IS PERFORMED.

3.1 Roll Feeder Mounting

The HE10 and RF06 was fully assembled and tested as a unit at Outotec. For shipment, the roll feeder is disassembled from the main machine frame and strapped on a separate pallet. The roll feeder (RF06) must be reset on the HE10 main frame before the machine can be used.



Figure 3.1.1



Figure 3.1.2



Figure 3.1.3

With the lift eyes mounted to the RF06 frame, the feeder can be lifted and then lowered onto studs on the top of main machine frame. The RF06 frame should be adjusted so that it is centered left-to-right on the main machine frame (Figure 3.1.1). The alignment tool is used to set the alignment of the two frames at the front (Figure 3.1.2). When the RF06 frame is properly adjusted on the main frame, the frames are bolted together with the nut, lock-washer, & flat-washer sets that shipped with the main machine (Figure 3.1.3).



Figure 3.1.4



Figure 3.1.5

After the roll feeder is aligned in a front and side-to-side sense, the aft door seal bar (Figure 3.1.4) may need to be repositioned so that it is flush with the aft vertical supports of the roll feeder frame.

Also, the front door feather on the roll feeder may need adjustment so that it is flush with the front vertical supports on the main machine frame (Figure 3.1.5). The operation of the front roll feeder door should be checked with respect to the top door on the main machine. Note that the front roll feeder door must be closed and fastened with the quick thread screws before the top door of the main machine is opened or closed.

3.2 Roll Feeder Connection

With the RF06 mechanically installed to the main machine, the electrical connections for the roll feeder motor and the feed material over-temperature protection system (optional) should be completed.



MACHINE POWER SHOULD BE DISCONNECTED BEFORE THIS CONNECTION IS PERFORMED.

The RF06 motor wires labeled ONE, TWO, and THREE should be connected to motor terminals T1, T2, and T3 respectively (Figure 3.2.1); after these connections are made, the cord grip for the RF06 motor should be tightened to provide strain relief for the power cable.



Figure 3.2.1



Figure 3.2.2

If present, the multi-pole molded cable for the feed material over-temperature protection system (Figure 3.2.2) should be connected. After this connection is made, the one hole clamps for both the motor power cable & the feed material over-temperature cable should be installed to secure the cables to the RF06 frame.

3.3 HE10 Handling

The HE10 machine can be handled on the ground using a fork truck with forks spread to their maximum width and 72 in. fork extensions mounted on each fork. The machine can be lifted from either the front or the backside by placing the forks under the lowest two cross-members of the machine. The general assembly drawing shows the location of the CG of the HE10. Riggers should assure that their fork truck capacity is not exceeded. Also, careful attention to fork placement is needed to make sure that the machine does not tip and slide off the forks while the machine is being moved.

The HE10, both with and without RF06 mounted, can be lifted with straps or chains when the lift eyes are bolted to the main frame. Riggers should assure the lift gear capacity is sufficient to handle the HE10. The general assembly drawing shows the location of the CG of the HE10.

3.4 HE Positioning & Mechanical Connection

The HE10 should be mounted properly with respect to the load bearing members in the facility. The general assembly drawing shows the recommended clearances that should be maintained around the machine for maintenance. The main frame can be fastened to the floor by thru bolting or welding. The positioning of the machine should take into account the material feed and discharge constraints as well as the utility requirements.

Material feed and discharge issues should be addressed before the machine is operated. Both material inlet ports on the roll feeder should be fed with the material to be separated; this will assure that the full width of the roll feeder will be supplied with material. Product discharge chutes should be connected to the three holes in the bottom hopper of the HE10. In some instances, the product from the aft two discharge holes will be combined in a single magnetic product.

Before the machine is operated, the purge air and dust extraction systems should be connected to the customers plant supplies. Particles are prevented from entering the HE10 cassette internal spaces by clean purge air blown through small holes in the cassette crossbar. Either a straight or elbow barb fitting can be attached to the 1.0in. NPT nipple on the drive end of each cassette bar. Airflow is produced by the customers low or medium-pressure blower and pushed into each cassette crossbar. Each cassette should be purged with about 50 m³/h to keep the internal belt surface from accumulating a thick layer of dust. Compressed air is not recommended for purging the cassette cavity; it is expensive to produce and difficult to keep this supply oil and water free.

Very fine dust particles should be removed from the HE10 cabinet by attaching the customers vacuum system to the 3in. diameter (OD) exhaust ports located on the drive side of the roll feeder and on hoppers. The HE10 has an exhaust port for each separation stage. The dust extraction for the 1st stage cassette is done from the exhaust plenum in the roll feeder. Each of dust extraction ports should be connected to the plant dust extraction system and about 50 m³/h of air should be pulled from each port (to balance the cassette purge air). The amount of air extracted from each stage can be tuned by adjusting the throttle plates on each plenum.

3.5 Removal of Cassette Shipping Bracket

Each of the HE10 cassettes is secured at the drive end with a removable shipping bracket (yellow arm in Figure 3.5.1). This bracket and the fastening hardware should be removed once the machine has been installed.



Figure 3.5.1

3.6 Roll Feeder Pre-Roll Funnel & Gate Adjustment



THESE ADJUSTMENTS ARE DONE WITH MACHINE POWER OFF OR MACHINE CONTROL IN E-STOP AT THE MACHINE JUNCTION BOX.

The pre-roll funnel on the roll feeder was fully adjusted at the factory. The following check is suggested to prevent damage to the rubber-lined feed roll should the funnel be knocked down onto the roll surface due to a rough shipping event.



Figure 3.6.1



Figure 3.6.2

The pre roll funnel should ride close, but not touch, the rubber lined feed roll on the sides and on the back edges. Spacers (2mm) can be used to set the gap of the pre-roll funnel on these three sides; this is shown in Figure 3.6.1.

After this is done, the gate gap is set between 2mm to 6mm at shown in Figure 3.6.2. The gap is set to about 2.7X the largest material grain size. This guidance can be adjusted as necessary to make the metering function of the roll work, but also to allow complete feed stop of material feed when feeder roll is stopped.

3.7 HE10 Electrical Connection



BRANCH POWER SHOULD BE DISCONNECTED BEFORE THESE CONNECTIONS ARE PERFORMED.

The customer normally supplies the electrical cabling between the HE10 junction box and the HE10 controller. The controller can be located near the machine or with other equipment in a remote MCC room. The machine electrical schematics show the details of the interconnection between the machine junction box and the machine controller; an electrician following the applicable local codes should do this connection.

After the machine junction box is wired to the machine controller, the machine controller should be connected to the customer supply.

3.8 HE10 Pre-Start Checklist

Before the HE10 is brought out of E-stop, each of the following steps should be performed. Some of the steps listed below are covered in more detail in the maintenance section of this manual. While executing this checklist, the HE10 should be in power off or in E-stop mode:

- 1) Roll feeder installed & bolted to main machine (if RF06 supplied).
- 2) Main machine installed (see machine-specific General Assembly Drawing).
- 3) Machine control hooked to customer power supply machine junction box (see machine-specific Electrical Schematics).
- 4) Shipping brackets removed from cassettes.
- 5) Roll funnel & gate adjusted to not touch RF06 feed roll.
- 6) Magnet roll & idler rolls clean of debris.
- 7) Belts installed. Idlers tensioned. Cassettes spun by hand.
- 8) Cassette hinges set to $\frac{3}{4}$ towards full high.
- 9) Transition chutes gapped, set full aft & locked in place.
Splitters adjusted to some initial position & locked



READ ALL SECTIONS OF THIS MANUAL BEFORE PROCEEDING TO MACHINE COMMISSIONING.

4.0 Commissioning



ENTANGLEMENT HAZARDS PRESENT IN OPERATING CASSETTE & ROLL-FEEDER MECHANISMS. USE TOOL ONLY TO ADJUST OPERATING CASSETTES.

After each of the steps in the pre-start checklist has been completed, the machine is ready to be commissioned. This is done in stages to assure that the machine cassettes, and then the roll feeder are ready to process mineral product. Some of the commissioning steps listed below are covered in more detail in the maintenance section of this manual:

- 1) Start each cassette at 50RPM to do the initial belt tracking adjustment. Run each cassette separately (with the other cassettes stopped). At this point, verify that the cassette is turning in the correct direction; if the motor direction is wrong, the Gearmotor connections should be re-phased by a qualified electrician.
- 2) When low-speed tracking is acceptable, run cassette at 300RPM (with other cassettes stopped) and do belt tracking adjustment at this higher speed. Use tool only to adjust operating cassettes. Do the low- and high-speed tracking adjustments described above to each cassette.
- 3) With material feed to roll-feeder blocked, start roll feeder & listen/observe for interference between feed roll and the pre-roll funnel & gate. With machine in E-stop, correct any interference to prevent damage to RF06 feed roll. At this point, verify that the feed roll is turning in the correct direction.
- 4) Assure that downstream equipment is ready to receive HE10 product. Start all cassettes. Allow material to enter the roll feeder hopper. With RF06 feed roll stopped, check to see that no significant amount of material leaks out of pre-roll funnel or feed gate. Do this carefully to avoid entanglement hazard with 1st stage cassette. If pre-roll funnel or feed gate adjustments are necessary, this should be done with the machine in E-stop.

- 5) With cassettes running, start the roll feeder and observe that material flows from the gap between the gate and the rubber-lined feed roll. Now, stop the feed roll, the flow of material should stop. If it does not, the gate gap should be set smaller. If gate adjustments are necessary, this should be done with the machine in E-stop.
- 6) It is very important that the flow from the roll feeder gate is uniform across the width of the feeder. An even feed will properly deliver material across the 1st stage magnet roll. If the flow is not uniform, the roll feeder gate needs to be adjusted slightly to correct this problem. Gate adjustments should be done with the machine in E-stop.
- 7) When the roll feeder is delivering a width-uniform stream of material into the 1st stage transition chute, and all the cassettes are tracking without button hopping, the HE10 is ready to process material.

Finally, an experienced technician should set each splitter to achieve the desired product recovery & grade.

5.0 Operating



ENTANGLEMENT HAZARDS IN CASSETTES & ROLL-FEEDER! STAY CLEAR OF THESE MECHANISMS.

The operation parameters of the HE10 are roll speed, feed rate, and belt thickness. Sometimes, the splitter setting may be considered a parameter. These parameters are typically investigated by prior small-scale laboratory tests with a representative material sample. These laboratory tests usually also suggest the magnetic configuration & strength as well as the number separation stages appropriate for a customer's objectives. Often, the optimum settings for the roll speed, feed rate, and belt thickness are finalized only after operating the separator in full-scale separation.

5.1 Roll Speed:

The roll speed changes the basic trajectory of the material stream falling off the magnet roll. Because HE10 feeds material directly on the magnet roll, the material has little residency time in which to take on the peripheral roll velocity and direction. Because the basic material trajectory does still change with roll speed, splitter settings must usually be changed when the roll speed parameter is changed.

For highly magnetic materials, the roll speed for the HE10 may be between 300 and 500 rpm, even with thick belts. This results in a very sharp separation, and high unit capacity.

For less magnetic particles, the speed must be reduced, sometimes as low as 60-70 rpm for cleaning of ultra-pure materials.

5.2 Feed Rate:

The importance of a uniform feed stream cannot be overemphasized. A uniform bed of material should be delivered on the active width of the magnet roll so that no one section of the magnet roll becomes over or under-loaded. This desirable uniform feed stream originates with a uniform gap setting on the RF06 gate (see Figure 3.6.2).



ENTANGLEMENT HAZARDS IN CASSETTES & ROLL-FEEDER! STAY CLEAR OF THESE MECHANISMS.

Another factor controlling the uniformity of the feed stream is the throttle plate bolted to the bottom of each transition chute; the throat gap should be consistent across the width of the transition chute.

It is also important to consider the bed thickness delivered to the magnet roll. The magnetic force is greater close to the magnetic roll surface. Consequently, a thin stream thickness is required for delicate separations, while a thicker stream (up to about 4-5 mm for particles finer than 0.8 mm (-20 mesh)) can be used for most applications. The bed thickness is adjusted primarily by adjusting the speed of the RF06 feed roll.

5.3 Belt Thickness:

Three standard belt thicknesses are available: 0.125 mm (0.005"), 0.25 mm (0.010") and 0.5 mm (0.020"). The most common production belt is 0.25 mm thick. If greater magnetic force is required, the thinner 0.125 mm belt may be used. It is usually recommended that the first stage of separation use at least a 0.25 mm thick belt.

5.4 Splitter Setting:

The standard splitter is composed of one blade located under and just forward of the magnet roll. To set the splitter angle, loosen the knob and move the pointer to the desired position. If the cassette is in motion, use the pointer (on the outside of the machine) to move the splitter blade.



IF SPLITTER ADJUSTMENT IS DONE WITH THE DOORS OPEN AND MACHINE OPERATING, CARE MUST BE TAKEN TO KEEP HANDS CLEAR OF THE BELT AND ROTATING ROLLS.

In the majority of cases, the splitter will be set as close as possible to the stream that is considered the product, without cutting into the stream. In a few cases, the splitter may be set to cut in the stream to achieve the desired split.

6.0 Maintenance

6.1 Belt Installation:



MOST OF THE ADJUSTMENT STEPS BELOW ARE DONE WITH MACHINE POWER OFF OR MACHINE CONTROL IN E-STOP AT THE MACHINE JUNCTION BOX.

In normal HE10 operation, the Kevlar reinforced belts will either break or wear out after they have been in service for several months. The procedures below should be followed to replace the belt:



Figure 6.1.1

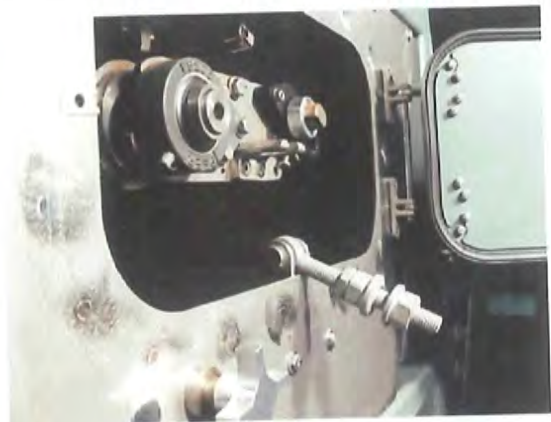


Figure 6.1.2



Figure 6.1.3



Figure 6.1.4

- 1) Machine should be powered-off or machine control put in E-stop at the machine junction box.
- 2) The front and side doors should be opened to provide access to the cassette to be serviced.
- 3) The flange nut on the non-drive end swing bolt should be loosened and unscrewed about three turns machine (Figure 6.1.1).
- 4) Grasp the top of the swing bolt and pull outwards to rotate the bolt 90 degrees. The cassette will be hanging without support on the drive end, but is well supported from the drive side of the machine (Figure 6.1.2).
- 5) At the end of the idler roll, slide the idler roll up and towards the magnet roll to cause the idler shaft to lock into the notches in the hinges. Do this on both sides of the machine. The belt will become loose (Figure 6.1.3).
- 6) Remove worn belt from the machine.
- 7) Before mounting the new belt, ensure that both the magnet and idler roll is clean of all debris. On the magnet roll, wipe any adhering (sometimes highly magnetic) material starting from the center of the magnet roll, out to the sides where the magnets are not present. This will allow magnetic material to release from the magnet roll.
- 8) Slide the new belt onto the magnet & idler roll, taking care not to crease the new belt (Figure 6.1.4). Make sure that the belt is centered and the buttons will fall into the grooves at the roll ends.
- 9) At the idler roll ends, lift the idler roll up and away from the magnet roll to cause the idler roll to slide down the hinge slots. Do this on both sides of the machine. This will tighten the belt. At this point, the buttons at the belt edges should fall into the grooves of both the magnet & idler rolls.

- 10) Turn the magnet roll by hand to check that nothing is interfering with the roll or belt motion and the buttons seem to ride in the grooves of both rolls.
- 11) Grasp the top of the swing bolt and rotate it back into the cassette fork. The swing bolt should slide into the fork as to not move the cassette forward or aft. The spherical nut on the swing bolt should slightly lift the cassette as the bolt fully enters the slot. This puts a vertical preload on the swing bolt.
- 12) The flange nut on swing bolt should be spun down on the fork and wrench tightened to secure the cassette.



CASSETTE SWING BOLT MUST BE UP AND BOLTED TO CASSETTE FORK BEFORE CASSETTE DRIVE IS OPERATED.

- 13) The belt tracking (described in the section below) procedure should be performed with the machine powered up and out of E-stop.
- 14) The front and side doors should be closed after the belt changing & tracking adjustments are complete.

6.2 Belt Tracking:

During the initial start-up and periodically during machine operation, the HE10 cassettes should periodically be inspected to see that the belts are tracking properly. A belt is tracking properly when the belt buttons ride in the magnet and idler roll tracking grooves without hopping the groove edges of either roll. To obtain this condition, the cassette hinges are adjusted so that the belt does not strongly track to one side or the other. A properly tracking belt is either silent or exhibits only a slight clattering noise as the tracking buttons encounter the guiding edges of the magnet and idler roll.



Figure 6.2.1



Figure 6.2.2



Figure 6.2.3



Figure 6.2.4

For initial cassette startup, both cassette hinges should be set at about $\frac{3}{4}$ high position; Figure 6.2.1 shows a cassette hinge adjusted to this position. The adjustment screws are turned to raise or lower the hinges. When the cassette is operating, only a tool should be used to turn the adjustment screw (Figure 6.2.2).

The cassette hinges can take in a wide range of angles. Figure 6.2.3 shows a cassette hinge set low. Figure 6.2.4 shows a cassette hinge set high. The HE10 cassette hinges are generally set higher to improve belt tracking. When the hinges are higher, the idler roll tends to tension the belt with a lower force. This makes the belt track more gently against the magnet and idler roll tracking edges.

Each cassette should be started about 50RPM to do the initial tracking adjustment. The other cassettes should not be running so that the cassette being studied can be heard clearly. On operating cassettes, ALWAYS use a tool to turn the hinge adjustment screw (see Figure 6.2.4). Using a tool will reduce the risk of operator entanglement in the belt & rolls of the cassette.

Two strategies can be used to cure the button hopping (i.e., a poorly tracking belt). First, the hinge can be set lower on side on belt where button hopping occurs. Use a small adjustment of the screw (½- to-1 turn) and then wait to see if the button hopping ceases. Repeat these small adjustments as needed.

Since it is generally better to use high hinge settings, a second adjustment method calls for setting the hinge higher on the side opposite to button hopping occurrences. This method tends to push the hinges higher as the adjustment proceeds.

When low-speed tracking is acceptable run cassette at 300RPM (with other cassettes stopped) and do belt tracking adjustment at this higher speed.

6.3 Yaw & Roll Adjustment of Cassettes Relative to Front Splitter:



THESE ADJUSTMENT STEPS ARE DONE WITH MACHINE POWER OFF OR MACHINE CONTROL IN E-STOP AT THE MACHINE JUNCTION BOX.

To maintain best separation efficiency, each magnetic roll axis should be parallel with the edge of the front splitter blade that resides below that magnet roll. The HE10 design allows for precise alignment of each magnet roll with its' corresponding splitter. The yaw & roll alignment is done on each cassette at the factory. Periodically, this parallelism should be checked to make sure that the cassette has not been moved out of alignment by some inadvertent operator action.

The alignment is done with the (non-drive end) swing bolt rotated out of the cassette fork; this step allows the cassette to take on its' natural position as the alignment procedure is performed. The check is done by attaching a tool (Figure 6.3.1) to the forward quadrant of the magnet roll. The tool is made of aluminum angle with has ferrous targets that hold it aligned to the magnet roll axis. The tool provides a reference edge that can be put in close proximity to the top edge of the forward splitter. In this way, the parallelism of the roll axis to the splitter edge can be judged in both a yaw and roll sense. If this check shows that the magnet axis is substantially out of parallel with the splitter edge, then adjustments can be made to correct the cassette alignment.

Figure 6.3.2 shows the yaw arm of a cassette being adjusted to make the cassette rotate in a "yaw sense" with respect to the splitter. Tightening the bolt set will compress the Belleville spring pack and make the cassette rotate counter clockwise in a yaw sense (when viewed from the top). Loosening the bolt set will allow the Belleville spring pack to push the yaw arm and rotate the cassette in a clockwise in a yaw sense (when viewed from the top).



Figure 6.3.1



Figure 6.3.2



Figure 6.3.3



Figure 6.3.4

Figure 6.3.3 shows the full nut on the cassette pull-bolt being adjusted to make the cassette rotate in a "roll sense" with respect to the splitter. Tightening the bolt set will raise the non-drive end of the cassette, i.e., make the cassette rotate in a counter clockwise roll sense (when viewed from the front of the machine). Loosening the bolt set will allow the cassette's own weight to rotate the cassette in a clockwise in a roll sense (when viewed from the front of the machine). In some cases, the hex bolt head may need to be held inside the machine cabinet by a 2nd assistant. In no case should the full nut be loosened to the point where the cassette foot is at risk of dropping out of the saddle.



NEVER PLACE ANY PART OF YOUR BODY IN FRONT OF THE CASSETTE STRONGBACK WHILE MAKING THIS ADJUSTMENT. AN UNLIKELY FAILURE OF THE PULL-BOLT COULD CAUSE THE CASSETTE FOOT TO RAPIDLY POP OUT OF THE SADDLE...MOVING DOWN BY 5 IN. AND OUT BY ABOUT 5IN. KEEP BODY AND LIMBS CLEAR OF THIS ZONE.

After adjusting the full nut to obtain the required roll adjustment on the cassette, the jam nut should be placed on the pull bolt and locked against the full nut (see Figure 6.3.4).

After the yaw and roll alignment is verified (with swing-bolt down), the non-drive end support may need to be moved to allow the swing bolt to swing up and engage the fork on the non drive end of the cassette. The non-drive end support is fastened to the machine frame with two large socket-head cap screws, and to the hopper with a smaller nut & bolt sets. The non-drive end support should be located to allow the swing bolt to enter the cassette fork without moving the cassette either forward or aft.

The spherical nut on the swing bolt should be adjusted so that the swing bolt slightly lifts the non-drive end of the cassette as it enters the cassette fork. This lifting action assures that the swing bolt takes some vertical preload when the swing bolt is locked in place. Once the correct position of the spherical nut is determined, it is locked in place with the swing bolt jam nut.

6.4 Bearing Maintenance:



THIS MAINTENANCE IS PERFORMED WITH MACHINE POWER OFF OR MACHINE CONTROL IN E-STOP AT THE MACHINE JUNCTION BOX.

The bearings on the cassette and roll feeder should be greased once per week in a very dusty plant, and at every start-up from cold condition. Greasing frequency can be reduced to once per month in non-dusty situations.

6.5 Gearmotor Removal from Cassette:

The cassette gearbox and motor do not require periodic lubrication. The Gearmotor assembly may, however, need to be removed from the cassette for replacement or other cassette maintenance.



THIS MAINTENANCE IS PERFORMED WITH MACHINE POWER OFF OR MACHINE CONTROL IN E-STOP AT THE MACHINE JUNCTION BOX.

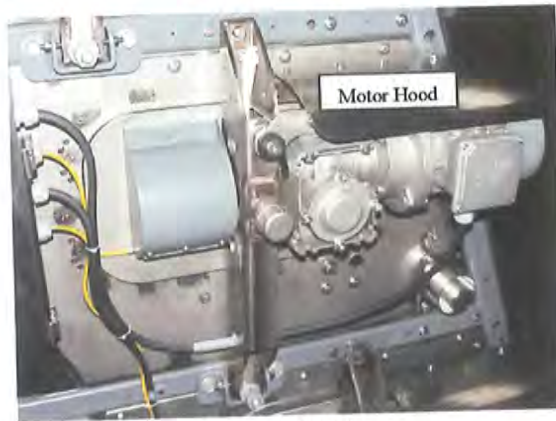


Figure 6.5.1



Figure 6.5.2

To provide the necessary clearance to slide the motor off the magnet roll shaft, the motor hood should be removed from the cassette yaw arm (Figure 6.5.1).

The motor should be unwired from the machine harness before it is mechanically removed from the cassette. The wire ordering for the three power wires should be noted before they are disconnected.

The Gearmotor assembly can be disconnected from the magnet roll by opening the access cover on the outboard side of the Gearmotor and removing the 3/8-16UNC cap screw and washer set that holds the gearbox to the magnet roll shaft (Figure 6.5.2).

Next, the torque arm should be unbolted from the cassette strongback (Figure 6.5.2). Pay close attention to the orientation of the nut, washers & bushing parts. As the nut is removed from the torque arm bolt, the Gearmotor will rotate some until it rests on the cassette strongback. At this point, the Gearmotor assembly (the torque arm & bushing too) can be pulled off the magnet roll shaft.

6.6 Gearmotor Removal from Roll Feeder:

The roll feeder gearbox and motor do not require periodic lubrication. The Gearmotor assembly may, however, need to be removed from the roll feeder for replacement or other RF06 maintenance.



THIS MAINTENANCE IS PERFORMED WITH MACHINE POWER OFF OR MACHINE CONTROL IN E-STOP AT THE MACHINE JUNCTION BOX.



Figure 6.6.1

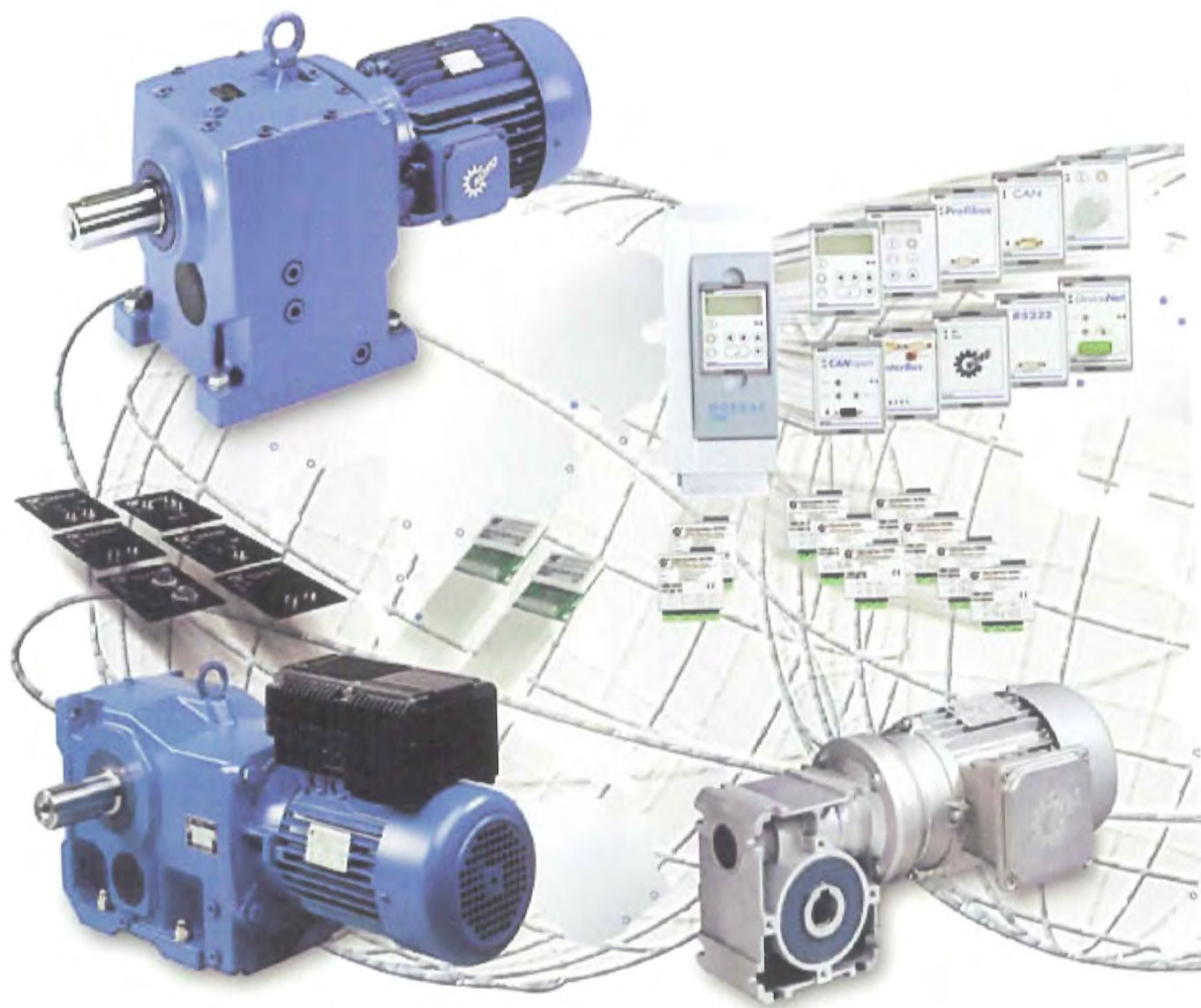
The motor should be unwired from the machine harness before it is mechanically removed from the roll feeder. The wire ordering for the three power wires should be noted before they are disconnected.

The Gearmotor assembly can be disconnected from the feed roll by opening the access cover on the outboard side of the Gearmotor and removing the 3/8-16UNC cap screw and washer set that holds the gearbox to the feed roll shaft (Figure 6.6.1).

Next, the torque arm should be unbolted from the roll feeder frame. Pay close attention to the orientation of the cap screw, washers & bushing parts. The Gearmotor should be supported to keep it from rotating as the cap screw is removed. At this point, the Gearmotor assembly (the torque arm & bushing too) can be pulled off the roll feeder shaft.

Appendix A
Nord Gearmotor Maintenance Instructions
(Included Here)

www.nord.com

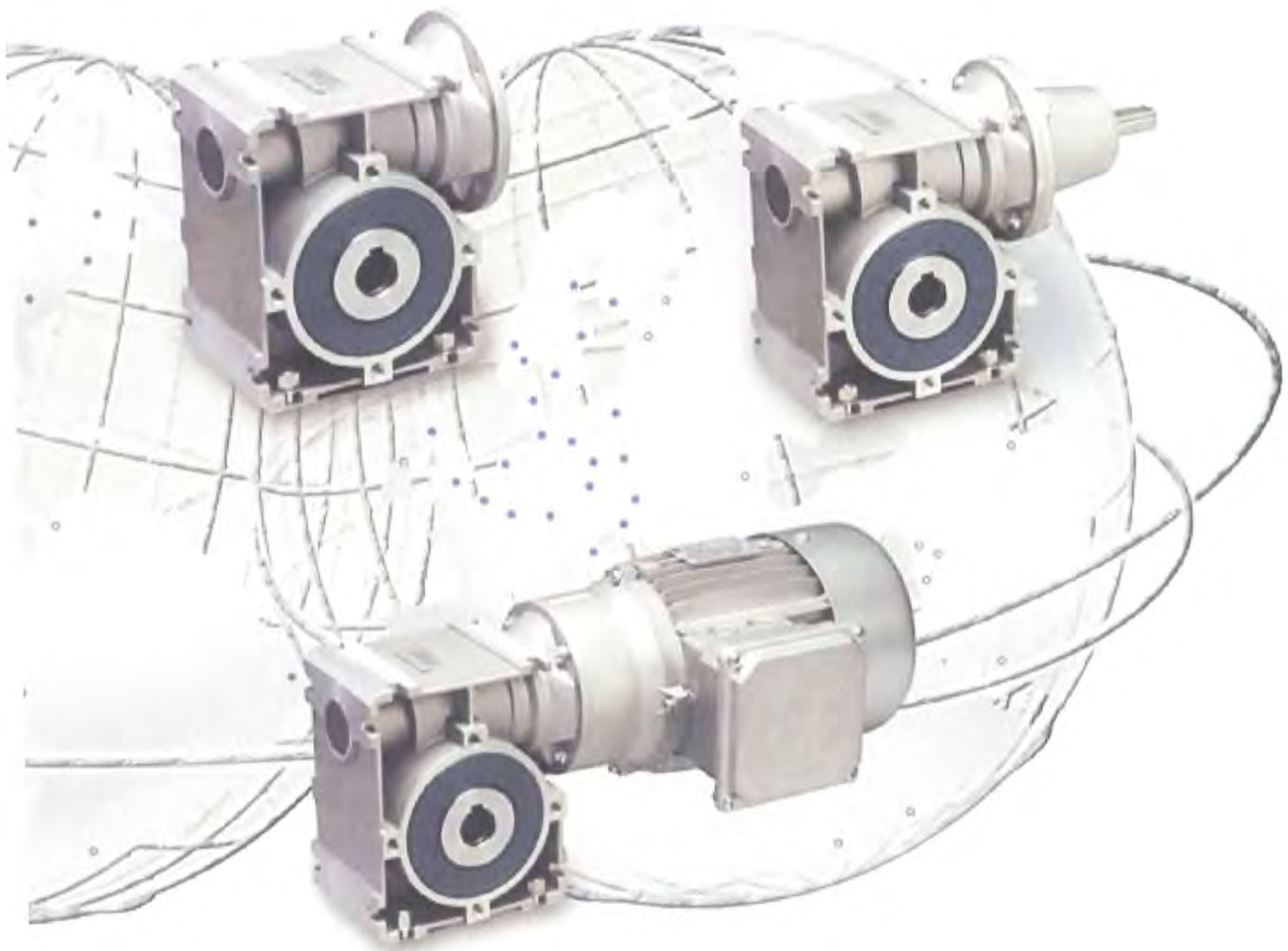


Betriebs- und Wartungsanleitung
Operating and Maintenance Instruction
Notice de mise en service et d'entretien

B 1033
11/2005



UNIVERSAL – Schneckengetriebe, Typ SD / SI
UNIVERSAL – Worm Gear Units, Typ SD / SI
**UNIVERSAL – Réducteurs à roue et
vis sans fin, Typ SD / SI**



Diese Sicherheitshinweise sind aufzubewahren
These safety instructions must be kept available
Ces instructions de sécurité doivent être observées

Getriebebau NORD

GmbH & Co. KG

D-22934 Bargtheide · P.O.Box 1262, D-22941 Bargtheide · Rudolf-Diesel-Straße 1
Tel. 0-45-32-/-401-0 · Fax 0-45-32-/-401-253 · NORD Internet: <http://www.nord.com>



Δ Warnung

Es wird vorausgesetzt, daß die grundsätzlichen Planungsarbeiten der Anlage sowie Transport, Montage, Installation, Inbetriebnahme, Wartung und Reparaturen von qualifiziertem Personal ausgeführt bzw. durch verantwortliche Fachkräfte kontrolliert werden. Bei Arbeiten am Getriebemotor muß garantiert sein, daß keinerlei Spannung anliegt, und dieser gegen Wiedereinschaltung gesichert ist.

Δ Warnung

Veränderungen gegenüber dem Normalbetrieb (höhere Leistungsaufnahme, Temperaturen, Schwingungen, Geräusche usw. oder Ansprechen der Überwachungseinrichtungen) lassen vermuten, daß die Funktion beeinträchtigt ist. Zur Vermeidung von Störungen, die Ihrerseits mittelbar oder unmittelbar schwere Personen- oder Sachschäden bewirken könnten, muß das zuständige Wartungspersonal dann umgehend verständigt werden.

Δ Im Zweifelsfall die entsprechenden Betriebsmittel sofort abschalten!

Aufstellung, Vorbereitung

- Fundamente ausreichend bemessen und schwingungsfrei ausführen
- Getriebe oder -motor fest und ohne Verspannung montieren
- ausreichende Belüftung vorsehen
- serienmäßiges Innengewinde nach DIN 332 zum Aufziehen von Verbindungselementen auf die Wellen benutzen
- Schläge auf die Wellen vermeiden (Lagerbeschädigung!)
- Maschine und Getriebe möglichst mit elastischen Kupplungen verbinden
- vor dem Einschalten Abtriebsselemente aufziehen bzw. Paßfeder sichern
- bei Aufsteckgetrieben mit Drehmomentstütze Gummipuffer verwenden
- die EU-Maschinenrichtlinie ist zu beachten
- bei Anwendungen bei denen der Ausfall eines Getriebe oder -motors zu einer Personengefährdung führen könnte, sind entsprechende Sicherheitsmaßnahmen vorzusehen

Elektrischer Anschluß

- Motoranschluß nach Schaltbild vornehmen
- Übereinstimmung von Netzspannung und Frequenz mit den Typenschild-Daten sicherstellen
- Sichere Schutzleiterverbindung herstellen
- evtl. falsche Drehrichtung korrigieren durch Vertauschen von 2 Phasen
- Nicht benötigte Kabeleinführungsöffnungen und den Käsen selbst staub- und wasserdicht verschließen
- Überbelastung und Phasenausfall durch Schutzschalter vorbeugen
- Einstellen des Motorschutzschalters auf Nennstrom
- Schaltbilder auf der letzten Seite
- Bei Bremsmotoren ist die Betriebs- und Wartungsanleitung B1090 zu beachten.

Wirkungsgrade

Da bei neuen Getrieben der Schneckenradsatz einlaufen muß, ist die Reibung zunächst noch größer als nach dem Einlauf.

Δ Caution

It is presumed that fundamental project work as well as all work with regard to transport, assembly, installation, starting-up, maintenance and repair is performed by qualified personnel resp. supervised by skilled labour taking overall responsibility. Make absolutely sure that no voltage is applied at all while work is being done on the geared motor. Drive must also be secured against switching on while work is in progress.

Δ Caution

Any deviation from normal operating conditions (increased power consumption, temperature, vibrations, noise etc.) or warning signals by monitoring equipment suggest malfunction. Inform the responsible maintenance personnel at once to prevent the trouble from getting worse and causing, directly or indirectly, serious physical injury or material damage.

Δ In case of doubt switch-off the machine immediately!

Preparing and performing installation

- the foundation (base) should be of adequate size and vibration-proof
- install gear unit or geared motor rigid and braceless
- ensure sufficient ventilation
- make use of tapped hole (DIN 332) to fit transmission element to the shaft end
- avoid shocks on shafts (bearing damage!)
- preferably use flexible coupling between output shaft and driven machine
- fit transmission element to shaft end or secure feather key before starting the motor
- use rubber buffer on shaft mounting gearboxes with torque arm
- the EC-machinery directive must be observed
- in applications where the failure of the gearbox or motor could be hazardous for personnel, appropriate safety measures must be taken

Connection of motor

- Connect motor according to diagram
- make sure that mains voltage/frequency are in accordance with nameplate information
- make secure protective conductor connection
- if motor is running in reverse direction, interchange two phases
- Close unused cable entrance holes and the box itself in a dust- and watertight manner.
- install protective switches to prevent overload and phase failure
- set motor protection switch to nominal current
- wiring diagrams on the last page
- When using brakemotors observe the O&M manual B1090

Efficiencies

New worm gearsets in gearboxes must be run-in for an initial phase before reaching their maximum rated efficiency. During the initial run-in phase the coefficient of friction is higher than after completing the run-in phase.

Δ Avertissement

Il est impératif que les travaux fondamentaux de l'installation, ainsi que tous les travaux de transport, montage, installation, mise en exploitation, entretien et réparation soient accomplis par du personnel qualifié et contrôlés par des techniciens spécialisés dans ce domaine. Avant toute intervention sur le motoréducteur, il faut s'assurer que celui-ci n'est plus sous tension et que la remise sous tension soit interdite.

Δ Avertissement

Si en utilisation normale, des modifications de fonctionnement apparaissent telles que puissance absorbée trop élevée, température élevée, vibrations fortes, bruit intense etc, ou en rapport avec les contrôles techniques, cela laisse supposer que différentes fonctions de l'appareil peuvent être détériorées. Pour éviter ensuite des problèmes, qui pourraient entraîner de graves accidents corporels ou de graves dégâts matériels, le personnel d'entretien compétent doit immédiatement être informé.

Δ Si vous êtes dans le doute, coupez immédiatement l'alimentation!

Mise en place, préparation

- prendre largement les dimensions des embases et les réaliser exemptes de vibrations
- monter les réducteurs et motoréducteurs solidement et sans haubanage
- prévoir une aération suffisante
- prévoir le taraudage conforme à la norme DIN 332 pour monter des accouplements sur les arbres d'entrée et de sortie
- éviter de donner des coups sur les arbres (cela pourrait détériorer le roulement!)
- lier autant que possible la machine et le réducteur avec des accouplements élastiques
- avant la mise en service, enlever l'élément d'accouplement ou/et fixer la clavette
- utiliser pour l'exécution arbre creux avec bras de réaction une butée en caoutchouc
- La directive machine EU est à prendre en considération
- pour les applications où la défaillance d'un réducteur ou d'un moteur pourrait blesser des personnes, des mesures de sécurité doivent être prises

Branchements électriques

- brancher le moteur selon le schéma
- s'assurer que la tension du réseau et la fréquence correspondent aux données inscrites sur la plaque signalétique
- Le câble de raccordement doit être protégé
- corriger un éventuel mauvais sens de rotation par une inversion de deux phases
- Les entrées de câbles non utilisées doivent être obturées, la boîte elle-même devant être fermée de façon à être élanche à l'eau et à la poussière
- prévoir une protection électrique contre les surcharges, court-circuit et défaut de phases
- régler la protection électrique suivant l'intensité nominale du moteur
- schéma de branchement à la dernière page
- Pour les moteurs frein veuillez vous reporter à la notice de mise en service et d'entretien B1090

Rendements

Le couple roue et vis d'un réducteur neuf doit fonctionner pendant quelques heures avant d'obtenir son rendement maximum. Pendant cette phase de rodage les rendements sont inférieurs aux rendements indiqués dans le catalogue.

Wartung

GETRIEBE/MOTOR

Die UNIVERSAL-Schneckengetriebe sind mit synthetischem Öl befüllt, dadurch ist über die gesamte Lebensdauer eine einwandfreie Funktion gewährleistet. Daher sind die UNIVERSAL-Schneckengetriebe wartungsfrei. Entlüftungsschrauben sind nicht erforderlich, die UNIVERSAL-Schneckengetriebe sind vollkommen geschlossen. Die Lager des Motors haben ebenfalls eine Lebensdauerschmierung. Bei Bremsmotoren ist die Betriebs- und Wartungsanleitung B1090 zu beachten.

Zusammenbau von Modulen und Anbau eines Motors

- Montageanleitungen der Anbau-Module beachten
- Eventuelle Hinweise des Motorlieferanten beachten
- Schläge auf die Motorwelle beim Aufstecken der Kupplungshülse vermeiden (Lagerbeschädigung)
- Bei Außenaufstellung oder feuchter Umgebung sind die Fugen zwischen Motor und Getriebe mit geeigneter Dichtpaste gegen Eindringen von Feuchtigkeit abzudichten.

Inbetriebnahme

- bei längeren Lagerzeiten besondere Vorkehrungen treffen (siehe Werknormblatt "Langzeittlagerung")
- Luftgekühlte Motoren sind für Umgebungstemperaturen von -20°C bis +40°C sowie Aufstellungshöhen bis 1.000 m über NN ausgelegt
- Der Einsatz im Ex-Bereich ist nicht zulässig, sofern nicht ausdrücklich von NORD geprüft und schriftlich freigegeben.
- Getriebe oder -motor nur mit den zulässigen Leistungsdaten betreiben

Maintenance

GEARBOX/MOTOR

The UNIVERSAL series of worm-gearboxes are filled with synthetic lubricant/bearing-grease. This ensures proper operation throughout the full lifetime of the units. Therefore UNIVERSAL drives are maintenance-free. No breather plugs are required. UNIVERSAL drives are completely sealed. The motor bearings are also lifetime lubricated. When using brakemotors observe the O&M manual B1090.

Assembly of modules and fitting of a motor

- observe the assembly instructions of the optional modules
- observe instructions of the motor supplier if any
- avoid shocks onto the motorshaft when fitting the coupling-sleeve (bearing damage !)
- For outdoor operation or in other humid/wet environment seal the gap between motor and gearbox with suitable sealant against the ingress of humidity.

Starting up

- in case of long-time storage take special precautions (as provided in works standard sheet "Extended Storage")
- air-cooled motors are designed for ambient temperatures between -20°C and +40°C and for installation at altitudes up to 1.000 m a.m.s.l.
- The use in hazardous areas is prohibited unless explicitly checked by NORD and confirmed in writing.
- Use gearbox or motor only within the permissible performance data

Entretien

DU REDUCTEUR/ DU MOTEUR

Les réducteurs et les motoréducteurs à roue et vis sans fin UNIVERSAL sont remplis d'huile synthétique ce qui garantit un bon fonctionnement pendant toute la durée de vie. De ce fait, les réducteurs à roue et vis sans fin UNIVERSAL ne nécessitent pas d'entretien. Les vis d'évent ne sont pas non plus nécessaires et les réducteurs à roue vis sans fin sont livrés entièrement fermés. Les roulements des moteurs sont également graissés à vie. Pour les moteurs frein veuillez vous reporter à la notice de mise en service et d'entretien B1090.

Assemblage des modules et montage du moteur

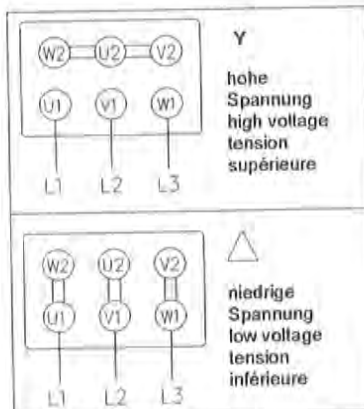
- prendre en considération la notice de montage
- éventuellement tenir compte des recommandations du fournisseur du moteur
- éviter les coups sur l'arbre du moteur lors du montage de l'accouplement (endommagement des roulements)
- Pour des installations à l'extérieur ou dans un milieu humide, il faut appliquer de la pâte à joint sur les plans de joint entre le moteur et le réducteur, ou entre les modules, pour éviter la pénétration d'humidité.

Mise en fonctionnement

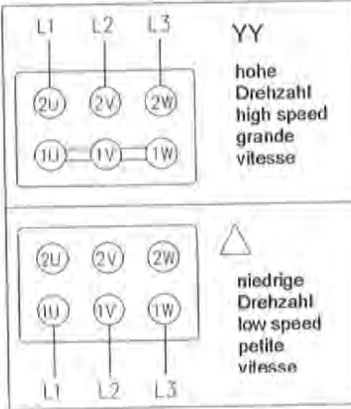
- si un stockage longue durée du réducteur est prévu, il faut prendre les dispositions nécessaires (voir spécification "Stockage longue durée")
- les moteurs autoventilés sont dimensionnés pour des températures ambiantes comprises entre -20°C et +40°C, ainsi que pour une altitude à 1000 mètres au-dessus du niveau de la mer
- Leur utilisation dans des atmosphères explosives Ex est interdite, à moins que ces moteurs ne soient expressément prévus à cet effet et avec accord écrit de NORD
- Les réducteurs et les moteurs ne doivent fonctionner qu'avec les caractéristiques de puissance indiquées.

Schaltbilder / Wiring diagrams / Schémas de branchement

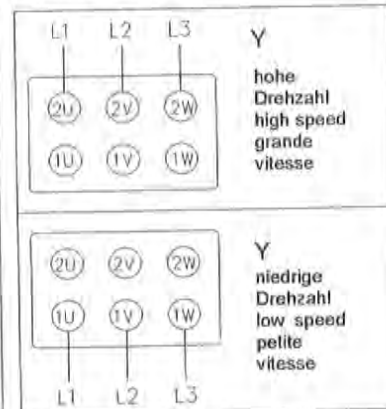
Drehstrommotor
Three phase motor
Moteur triphasé



Drehstrommotor, polumschaltbar
Dahlanderschaltung
Three phase motor, polechanging,
Dahlander connection
Moteur triphasé à commutation de pôles, couplage Dahlander



Drehstrommotor, polumschaltbar
getrennte Wicklungen
Three phase motor, polechanging,
separate windings
Moteur triphasé à commutation de pôles,
bobinages séparés



Appendix B

Optional Zero-Speed System (Included Here)

Appendix C
Optional Ionizer System &
Maintenance for Haug Ionizing Equipment
(Included Here)

6.1 Replacement of Fuse

- Switch off unit.
- Check cause of fuse failure and rectify fault.
- Open housing (with screw driver).
- Unscrew fuse holder with screwdriver.
- Replace fuse, using only the following types.
- Close housing (with screw driver).

Unit rating	Fuse
115 V	250 V, 500 mA semi time-lag
230 V	250 V, 250 mA semi time-lag

The unit rating is given on the rating plate.

NEVER USE REPAIRED FUSES OR SHORTCIRCUIT THE FUSE HOLDER.

7.1 Ratings and Specifications

The ratings apply after a warming-up period of 30 minutes (reference temperature 23 °C).

High-voltage connections

- EN C: 2 HAUG coaxial HV connections
- EN C4: 4 HAUG coaxial HV connections
- High-voltage: U = 7 kV (typ.) at C (load) = 1000 pF
- Connection output max.: EN C 10 m / 30 ft (ionizing unit including HT lead)
- EN C4 12 m / 35 ft (ionizing unit including HT lead)
- Short circuit current: I < 5 mA

- Supply voltage: 230 V or 115 V
- Nominal value: ± 10%
- Operating range: 50 - 60 Hz
- Frequency range: 40 VA
- Power consumption Pmax: + 5 °C to + 50 °C / + 40 °F to + 120 °F
- Ambient temperature: - 15 °C to + 60 °C / + 5 °F to 140 °F
- Nominal operating range: 20 % to 65 % RF
- Limit for storage and transport: 0 % to 85 % RF
- Air humidity: 20 % to 65 % RF
- Nominal operating range: 800 mbar to 1060 mbar
- Limit for storage and transport: max. 1,5 g (10 to 55 Hz), 1 h
- Vibration: Impact: max. 15 g in each direction
- Positioning: Vertical, power connections pointing downwards

Housing Protective cover to IP 41 Protection Class I, with integrated mains connection

Dimensions overall	Height	Width (including mounting bracket)	Depth (including mounting bracket)	Weight
EN C, EN C4	4,1" 104 mm	6,6" 167 mm	6,5" 165 mm	approx. 6,8 lbs 3,1 kg

USA GDN
Operating instructions
for power pack EN C / EN C4

For Types: EN C, EN C4

Please retain for future reference!

1 Safety	3. Positioning and Repair
2. Operating and Commissioning Elements	4. Operation
	5. Spare Parts
	6. Maintenance and Repairs
	7. Technical Data

The power packs are absolutely safe if used in accordance with these instructions. Failure to do so, whether by incorrect handling or misuse, can result in

- danger to the life of the operator
- damage to the equipment and other objects.

1.1 How to use the equipment

The power packs may only be used as a high-tension supply for HAUG ionizing equipment. They generate an alternating voltage of ca. 7 to 8 kV. They are suitable for the removal of electrostatic charges on glass, paper, plastic, etc. For safety reasons it is not permitted to alter or adapt the equipment. The instructions given here must be followed strictly. The power packs mentioned above are not suitable for hazardous areas.

1.2 Hazards

Any defects in HV sockets and leads may cause electric shocks. Therefore disconnect the equipment immediately if there is any visible defect or suspicion of a fault.



WARNING!
HIGH VOLTAGE - DANGER TO LIFE
DO NOT OPEN UNIT

1.3 Personnel Requirements

The installation and commissioning of the equipment must be carried out by qualified electrical engineers or technicians.

(Illustration on back cover)

2.1 Operating elements on the EN C, EN C4

- 1 ON / OFF switch; green light when ON
- 2 High-voltage (HV) connections
- 3 Mains lead
- 4 Ground / Earth connection

The installation and commissioning of the equipment must be carried out by qualified electrical engineers or technicians.

IMPORTANT

The functioning of the power pack is not affected by which way up it stands. However, we recommend vertical positioning with sockets for HV connectors pointing downwards (protection from damp, oil and dirt). It is also advisable to keep unused HV points sealed up.

Do not place power packs on heat-generating or heat-radiating surfaces or in direct sunlight.

WARNING!
HIGH VOLTAGE - DANGER TO LIFE
SWITCH OFF UNIT BEFORE CONNECTING
OR DISCONNECTING COAXIAL PLUGS



3.1 Positioning and Connecting

- Check whether equipment is suitable for existing mains voltage (compare with voltage given on rating plate). If not, do not connect equipment, otherwise it will be irreparably damaged.
- Position unit in appointed place. Use brackets supplied if mounting the unit.
- Connect ionizing units to high-voltage connectors.
- Connect ground / earth lead (green/yellow) to mains protective grounding. It is not sufficient to connect the grounded / earthed lead to a part of the machinery. It may be necessary to provide additional grounding / earthing.
- Ensure that the power pack is switched off.
- Connect power pack to mains.

Once the power pack and ionizing units have been properly connected, switch on the power pack.

5.1 Personnel requirements

The fault detection should be carried out by qualified electricians and personnel trained in electrical engineering.

WARNING
HIGH VOLTAGE - DANGER TO LIFE
SWITCH OFF UNIT BEFORE CONNECTING
OR DISCONNECTING COAXIAL PLUGS



5.2 Fault detection - Ionizing Systems

Proceed as follows:

- 1 Check installation:
 - Mains voltage: does it agree with that on the rating plate?
 - Is the power pack switched on (green lamp on)?
 - Check fuse if necessary.
 - Return equipment to manufacturer if necessary.
- 2 Is voltage output sufficient? (First check installation as under 1)
 - Disconnect all ionizing equipment from power pack.
 - Switch on power pack and check functions:
 - Light signal indicates proper functioning.
 - Carry out check with separate instrument, e.g. HAUG Multicheck (suitable for all power packs): Meter needle in green sector?
 - If necessary return power pack and connected ionizing units to manufacturer for checking.
- 3 Checking Ionizing Units (First check functions as under 2)
 - Connect each unit individually to power pack.
 - Switch on power pack.
 - Carry out check by following instructions under 2.
 - If the ionizing unit disrupts proper functioning, return it for checking.

WARNING
HIGH VOLTAGE - DANGER TO LIFE
DO NOT OPEN UNIT



The units do not contain any parts which require maintenance or repair by the user (except fuse). Any repairs or adjustments necessary may only be carried out by HAUG.

Appendix D
Optional Feed Over-temperature Protection System
(Included Here)

User's Guide



TX93 Thermocouple Two-Wire Temperature Transmitter

Shop online at

omega.com®

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e-mail: info@omega.com

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Engineering Service: 1-800-872-9436 / 1-800-USA-WHEN®
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WARNING: These products are not designed for use in, and should not be used for, human applications.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department, BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence. The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY RETURNS**, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

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FOR **NON-WARRANTY REPAIRS**, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.



Unpacking Instructions

Remove the Packing List and verify that you have received all equipment, including:

- TX93 Termocouple Two-Wire Temperature Transmitter
- Operator's Manual

If you have any questions about the shipment, please call the Customer Service Department.

When you receive the shipment, inspect the container and equipment for signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

TX93
Thermocouple Two-Wire Temperature Transmitter

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Thermocouple Two-Wire Temperature Transmitter**

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1

Introduction

1.1 General Description

The OMEGA® TX93 Thermocouple Two-Wire Temperature Transmitter accepts thermocouple sensor types J, K, T, or E and will produce a standard 4-20 mA output signal proportional to that produced by its attached input temperature sensor. Transmission of the proportional current output may be accomplished by using inexpensive copper wire.



Figure 1-1 TX93 Transmitter

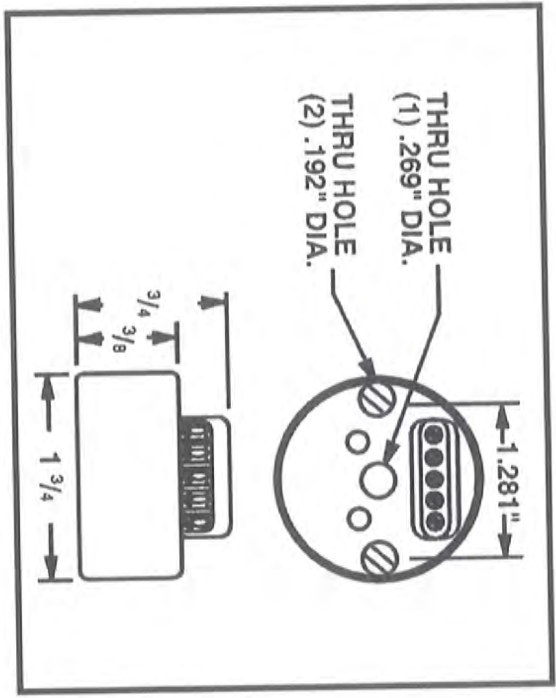


Figure 1-2 Dimensions (in inches)



The TX93 transmitter is normally powered by an unregulated power supply as shown in Figure 1-3. The proportionally-transmitted signal begins at 4 mA, at the low end of its temperature range, and increases to 20 mA, at the high end of its temperature range. (There are various temperature ranges thermocouple types available for the TX93. To order, refer to Section 1.3 for correct Model Numbers and Range Codes.)

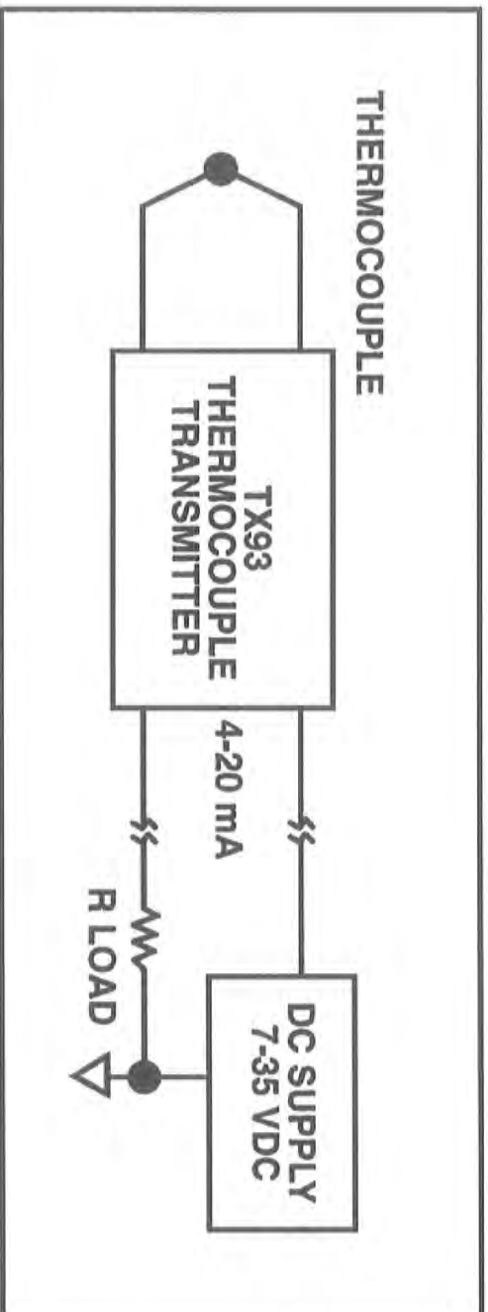


Figure 1-3 TX93 Thermocouple Transmitter

Introduction

1

The TX93 two-wire transmitter receives and measures signals from thermocouples and sends an output current of 4-20 mA which is directly proportional to the thermocouple millivolt input. It is designed to connect with only two copper wire leads that will supply the voltage to operate the transmitter from a power supply, and also carry the output current. The output current is used for recording, computing, or controlling.

If the TX93 is mounted inside a protection head, (see Figure 3-1), the thermocouple extension wires are replaced by two copper wires that carry the 4-20 mA signal and dc voltage to operate the transmitter.

1

Introduction

The TX93 has reverse supply polarity protection and will operate with a wide range of supply voltages (7 to 35 Vdc). It has an input sensor break-protection circuit that forces the output current to go upscale when the thermocouple wire opens. It also is provided with a screw terminal, where the output current can be measured without interrupting the power loop. The TX93 does NOT provide isolation between its input and the 4-20 mA output; therefore, an ungrounded thermocouple junction is suggested to prevent possible ground loops. Note that most thermocouple transmitters with 4-20 mA outputs, including the TX93, are proportional with respect to the thermocouple input voltage. However, the relationship between temperature and millivolt for all the thermocouple types is somewhat non-linear.

This leads to maximum error at approximately the midpoint of the range as shown in Figure 1-4.

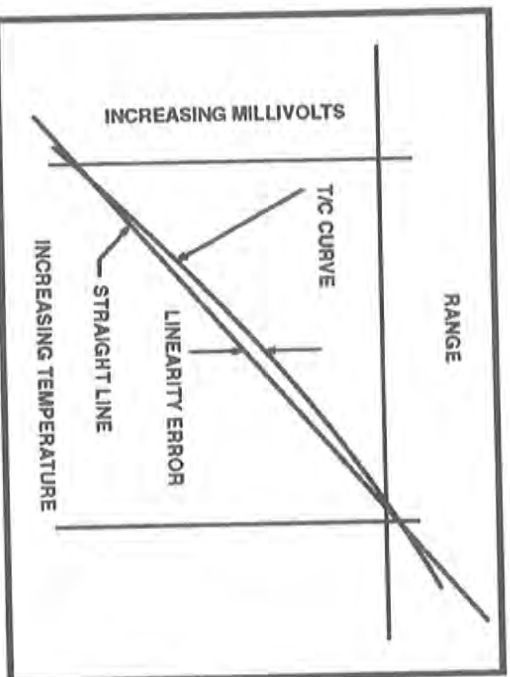


Figure 1-4 Straight Line Approximation of a Curve



Introduction

1.2 Features

- 4-20 mA output
- $\pm 0.1\%$ full-scale accuracy (with respect to the mV input signal)
- Upscale break protection
- Low Cost

1.3 Models Available

Table 1-1. Range Code

RANGE	INPUT TYPES			
	J	K	T	E
-40 to 120°F	J1	-	-	E1
0 to 200°F	J2	K2	T2	E2
0 to 300°F	J3	K3	T3	E3
0 to 500°F	J4	K4	T4	E4
0 to 750°F	J5	K5	T5	E5
0 to 1000°F	J6	K6	-	E6



Introduction

TX93 Models Available

Model Number	Description
TX93-(*)	Thermocouple Transmitter (J, K, T, or E)
NB1TX93-(*)	NB1 thermocouple probe, 12" L, 1/4" O.D., ungrounded junction, 304SS sheath

*Insert range code from Table 1-1

For complete information on NB1 Thermocouple probes, see the
OMEGA Temperature Measurement Handbook®.



2

Installation

3.1 Mounting the TX93

The TX93 transmitter may be:

1. surface mounted,
2. mounted inside a protection head (refer to Figure 2-1), or
3. installed into the OMEGA mounting track (part number RT) using an OMEGA mounting bracket (part number TX90-BR).
4. installed into standard 35mm DIN rail using an OMEGA DIN rail mounting adapter (part number TX-90-DIN).

Figure 2-2 shows the RT mounting track. Figure 2-3 shows the TX90-BR mounting bracket.

2

Installation

Figure 2-4 shows a typical installation using the bracket and mounting track. Figure 2-5 shows the TX90-DIN adapter.

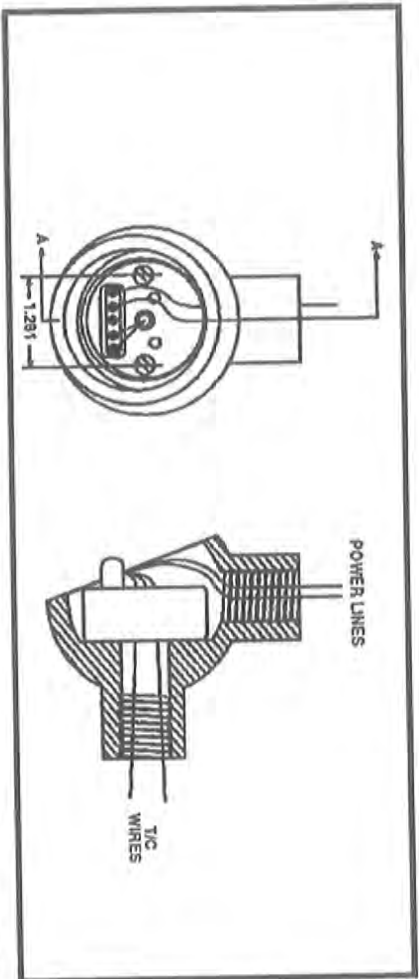
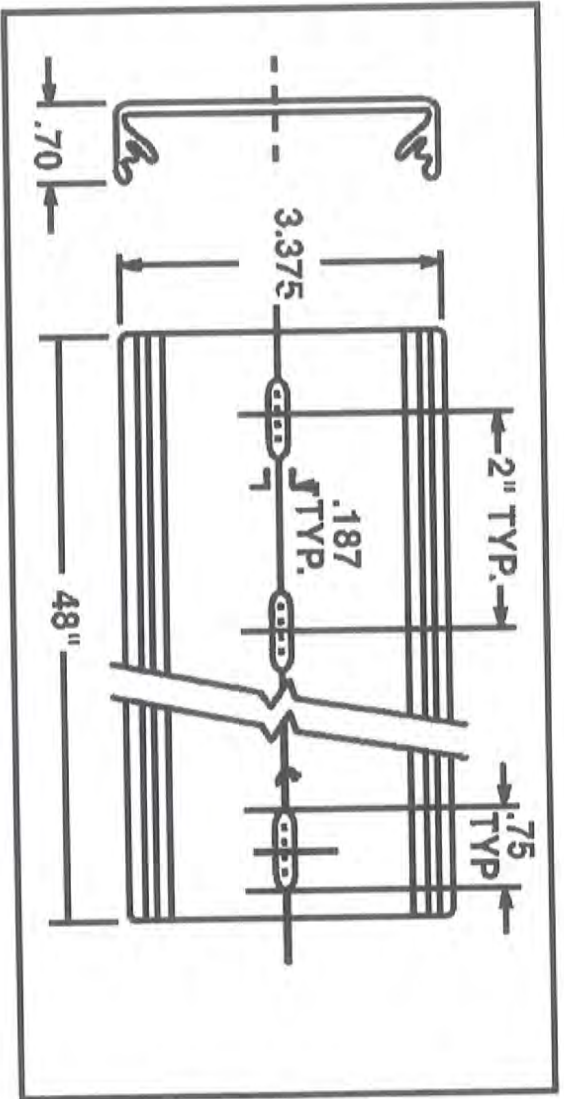


Figure 2-1 Assembly of the Transmitter inside an OMEGA NB1 Protection Head (Dimensions in inches)

Installation

2



CAUTION

Hand tighten transmitter mounting screws only. Do not overtighten.

Figure 2-2 RT Mounting Track (Dimensions in inches)

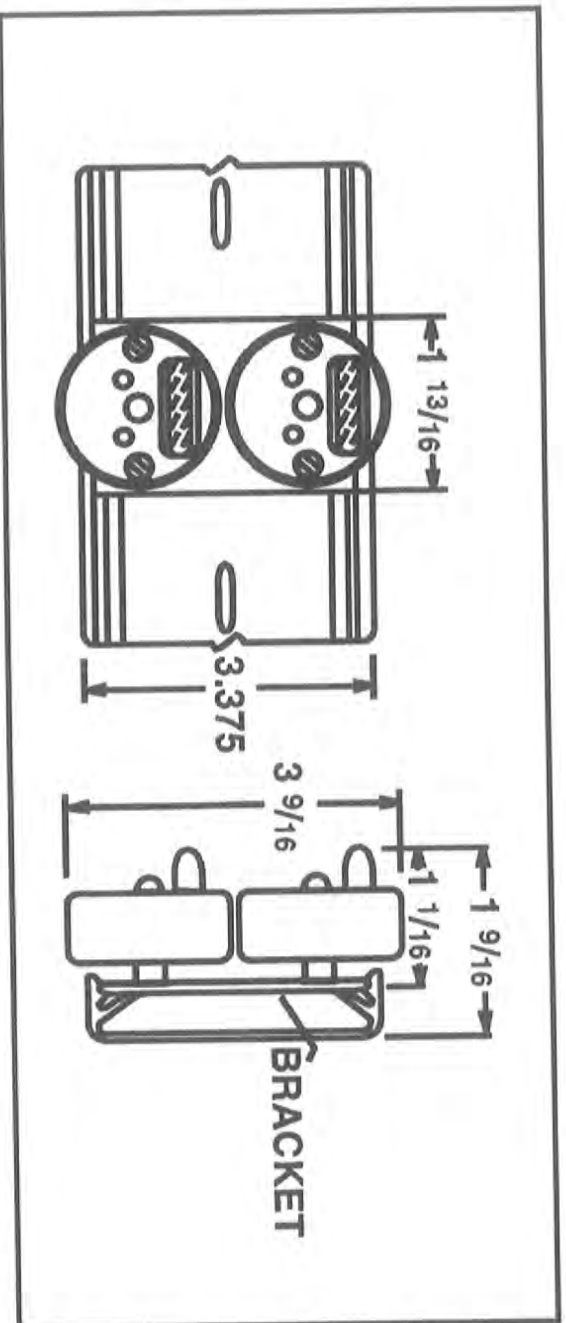


Figure 2-4 Installation with the Bracket and Track (Dimensions in inches)

2

Installation

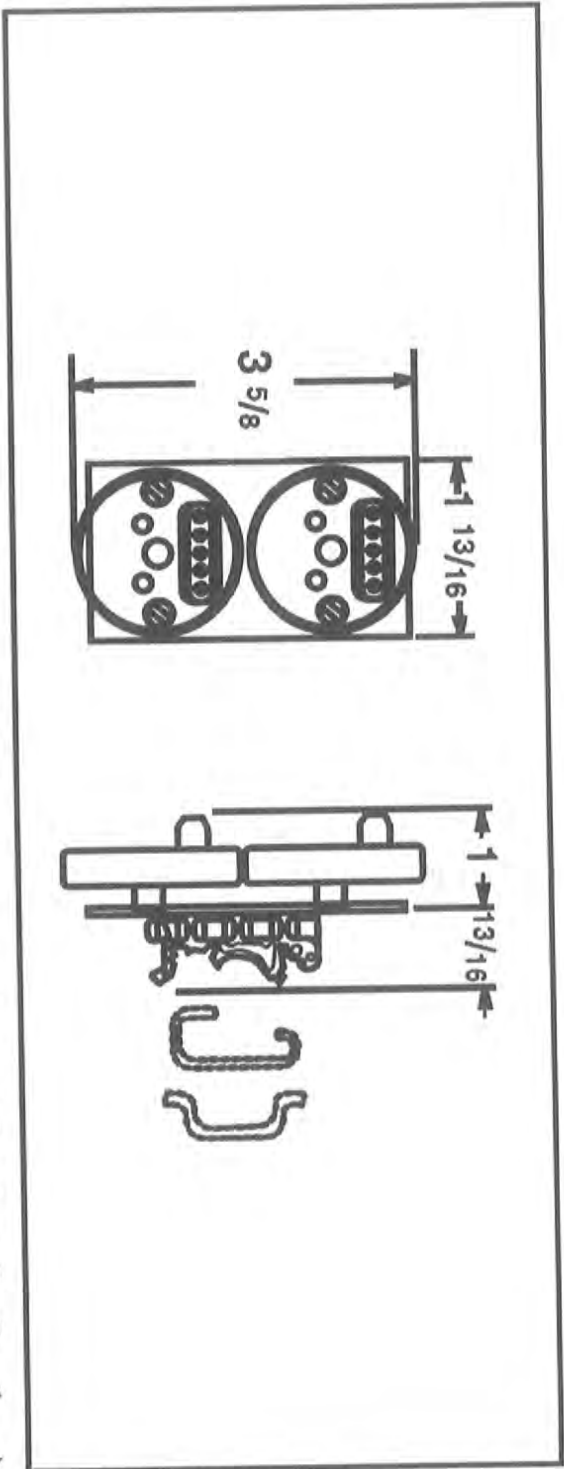


Figure 2-5 TX 90-DIN DIN Rail Mounting Adapter (in Inches)

2.2 Wiring the TX93 (Refer to Figure 2-6)

1. Connect a dc power supply in series with the load to the (+PS) and (-PS) power terminals. Note that the load (usually a monitoring instrument) may be connected to either the (+) or (-) power lead.
2. Connect the thermocouple to the (+IN) and (-IN) input terminals.

2

Installation

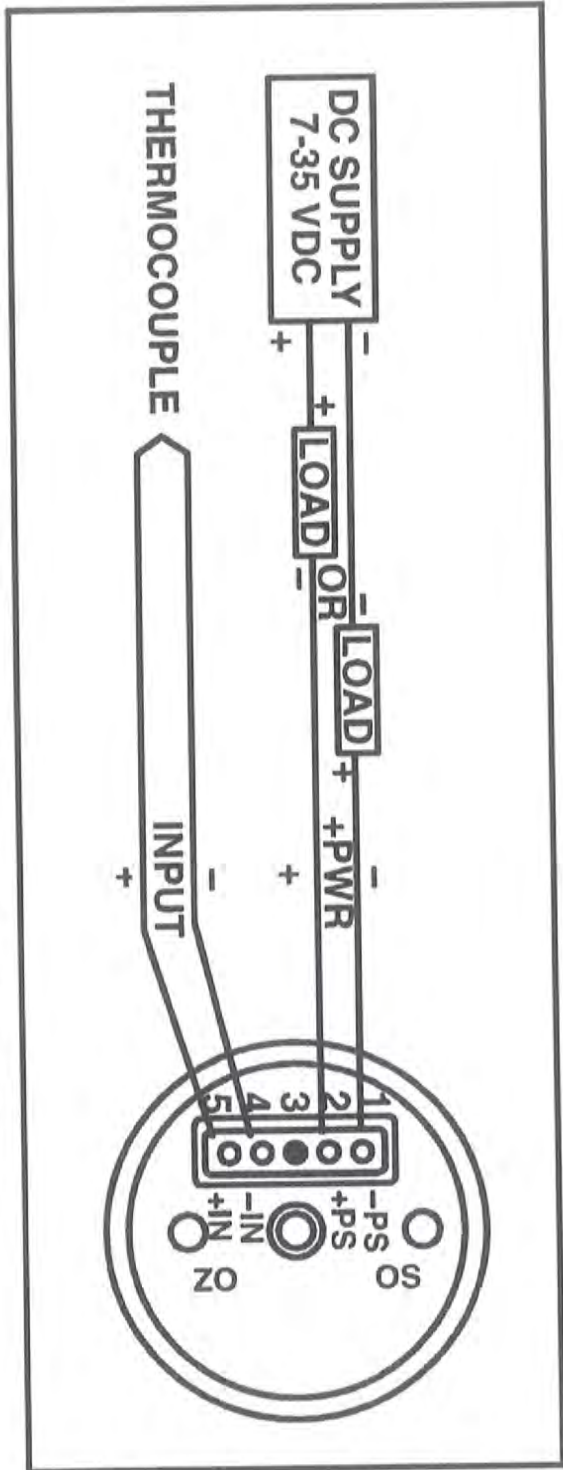


Figure 2-6 Wiring Diagram for the TX 93

3

Calibration Instructions

3.1 Equipment Required

- Precision mV source, with 0.001 mV resolution and ± 0.002 mV accuracy or
 - Precision DVM with ± 0.002 mV accuracy and an adjustable mV source with 0.001 mV resolution
 - OMEGA TRC III Ice Point Reference (or stable ice bath)
 - Temperature Reference Probe (OMEGA P/N: TRP-(*))
- *Thermocouple Type J, K, T, E

3.2 Set-Up of Equipment

To prepare the ice bath:

- a) Fill a glass beaker with crushed ice made from distilled water.
- b) Fill the beaker with enough distilled water so that the ice just becomes slush, but not enough to float the ice.
- c) Insert the reference thermocouple.

Figure 3-2 shows an alternate set-up. Here, a high precision thermocouple calibrator, such as the OMEGA Model CL511, replaces the DVM, ice bath, voltage source, etc.

3.3 Calibration Procedures (Refer to Figure 3-1)

Connect the calibration equipment according to Figure 3-1 or 3-2. The thermocouple wire must be of the same calibration as the transmitter being calibrated. Make sure that the wiring polarities are correct. (Note that the RED thermocouple wire is NEGATIVE).

To check or adjust the calibration:

1. Locate the Z (zero) and S (span) potentiometers.
2. Select, from Table 3-1, the correct mV input values for the Z (zero) and S (span) adjustments that correspond to the model number. For example, for Model TX93-I2, the Z input is -0.886 mV, and the S input is 4.907 mV.

Calibration Instructions

If a Thermocouple Calibrator/Simulator is used, such as the OMEGA Model CL511 Precision Calibrator, select the Temperature Input Z (zero) and S (span) values.

3. Set the dc mV source to the selected Z (zero) mV value. Adjust the Z potentiometer to read 4.000 mA on the monitoring instrument.
4. Set the dc mV source to the selected S (span) mV value. Adjust the S potentiometer to read 20.000 mA on the monitoring instrument.
5. Repeat steps 3 and 4, as required, until the readings are exactly 4.000 mA and 20.000 mA. This procedure is necessary since there is interaction between the two potentiometers.

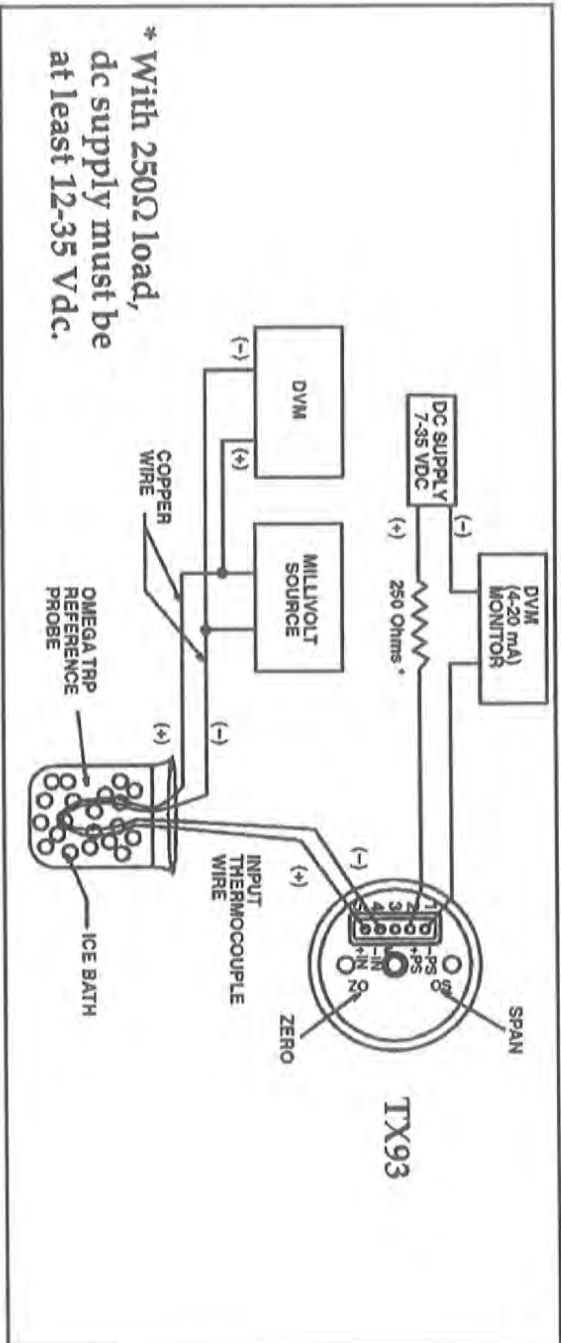


Figure 3-1 TX93 Calibration Set-Up

Calibration Instructions

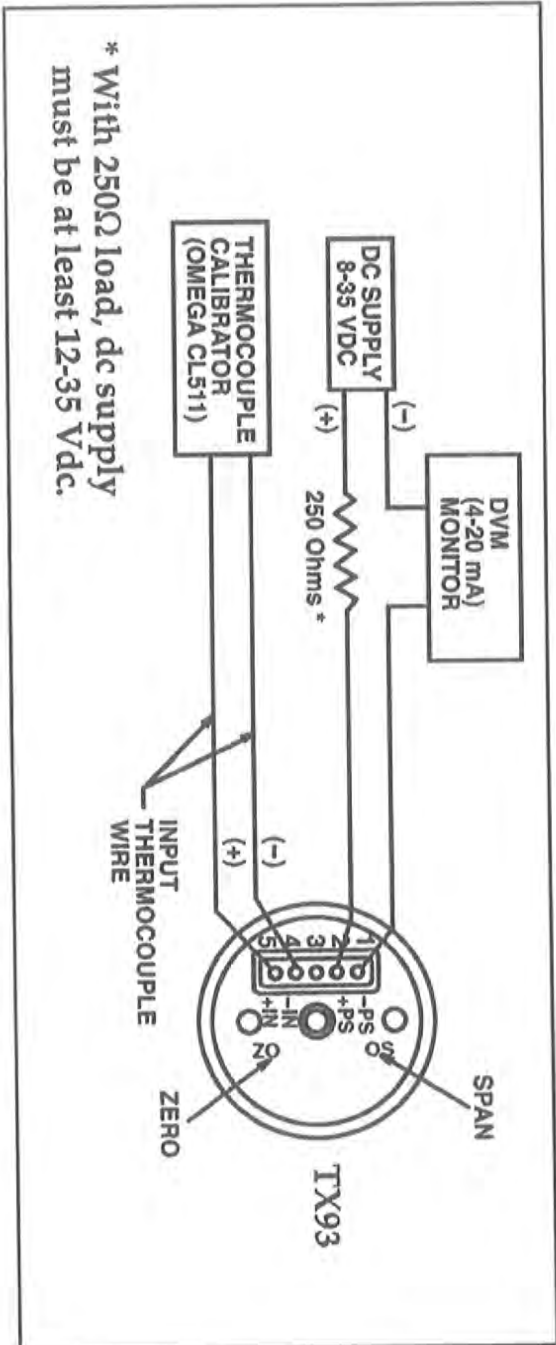


Figure 3-2 TX93 Calibration Set-Up (Alternate)

Table 3-1. Calibration Values for the TX93

Temperature Input Range Zero/Span	Model TX93	mV Input Ref 32°F Zero/Span	Model TX93	mV Input Ref 32°F Zero/Span
-40/120°F	-J1	-1.961/2.527	-	-
0/ 200°F	-J2	-0.886/4.907	-K2	-0.692/3.820
0/ 300°F	-J3	-0.886/7.949	-K3	-0.692/6.094
0/ 500°F	-J4	-0.886/14.110	-K4	-0.692/10.561
0/ 750°F	-J5	-0.886/21.787	-K5	-0.692/16.350
0/1000°F	-J6	-0.886/29.521	-K6	-0.692/22.255

Calibration Instructions

Table 3-1. Calibration Values for the TX93 (Continued)

Temperature Input Range Zero/Span	Model TX93	mV Input Ref 32°F Zero/Span	Model TX93	mV Input Ref 32°F Zero/Span
-40/120°F	-	-	-E1	-2.255/2.977
0/ 200°F	-T2	-0.675/3.968	-E2	-1.026/5.871
0/ 300°F	-T3	-0.675/6.648	-E3	-1.026/9.710
0/ 500°F	-T4	-0.675/12.574	-E4	-1.026/17.945
0/ 750°F	-T5	-0.675/20.803	-E5	-1.026/28.857
0/1000°F	-	-	-E6	-1.026/40.064

4

Troubleshooting Guide

Malfunction or incorrect operation may be caused by:

1. Reversed polarity:

Check the wiring using Figure 2-6 as a guide. If the temperature of the thermocouple increases while the current magnitude decreases, the problem could be caused by reversed polarity of the:

- a) thermocouple wiring
- b) power supply leads
- c) monitor instrument

Troubleshooting Guide

2. Loose or broken wires:

Check each terminal connection for tightness. Move each wire back and forth and note any changes in operation.

3. Too high a load resistance in the output current loop or too low a current rating on the power supply:

- a) Measure the total resistance of each device (excluding the transmitter and power supply) in the 20 mA loop, including the resistance of the lead wires.

- b) Calculate maximum allowable loop resistance using the formula: $\text{Loop Resistance (maximum)} = \frac{V_{\text{supply}} - 7V}{0.020A}$

For example, a 24V power supply would give a maximum loop resistance of: $17V / 0.020A = 850 \text{ ohms}$.

- c) Make sure the power supply is rated for at least 28 mA times the number of TX93 transmitters being powered. For example, if the supply is powering five transmitters, the supply should be rated for at least 140 mA.

5

Accessories

Model No.	Description
TX90-BR	Mounting Bracket
PSU-24B	Unregulated Power Supply, 24 Volts
TX82B	Process Loop-Powered Indicator
RT	48" Mounting Track
TX90-DIN	DIN Rail Mounting Adapter
RAIL-35-2	6.5' Section 35mm DIN Rail

6

Specifications

General

Size:	1.75" dia. X 0.75" high (includes terminal strip)
Zero/Span Adjustment Range:	±25%
Power Supply Voltage	
Operating Range:	+7 Vdc to +35 Vdc, 28 mA max required per transmitter
Accuracy:	±0.1% of full scale (includes effects of hysteresis, repeatability and linearity proportional to the T/C)
Frequency Response:	3dB@ 3Hz

Specifications

Ambient Temperature: -13°F to 185°F (-25°C to 85°C)

Storage Temperature

Range:

-85°F to 257°F (-65°C to 125°C)

Thermal Zero Shift:

<0.01%/°F of span (span >10 mV)

<0.02%/°F of span (4-10 mV span)

Thermal Span Shift:

<0.01%/°F of span

Weight:

1.0 oz (28g)

Output

Current Output Span: 4-20 mA dc

Current Output

Limits:

3 to 28 mA, typical

Maximum Loop

Resistance:

$$(V_{\text{supply}} - 7V) / 0.020A = \text{ohms}$$

Load Resistance Effect: 0.01% of span per 300 ohms change

Power Supply Effect: 0.002% of output span per volt

Input

Sensor:

Thermocouple

Input Break Protection: Upscale

Impedance: >30 M Ω

Source Current: 4 mA typical



Notes



Notes

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. The OMEGA® WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; or misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and traces.

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M2225/1104

Appendix E

Specialized Spare Parts List

(Included Here)

PHYSICAL SEPARATION SPARES LIST

Customer: POWERTEC CORPORATION
 Project: OPERATING MANUAL
 Equipment: HE10:150TS
 Project Ref No.: OP-24378HE10



Date Issued: 09-Nov-2007

Part Description	Application	Outotec Part No.	Category of Spare	Recommended Quantities	Lead Time (weeks)	Price each USD excl GST
Belt, 5mil X 1.5m Kev w/ Buttons	Cassette	BELT-10-164KS5	O	12	5	\$455.00
3 Bolt Flange Bearing for Magnetic Roll Control End	Cassette	BEARING-0002	O	18	4	\$34.00
2 Bolt Bearing for Magnetic Roll Drive End	Cassette	BEARING-0001	O	18	4	\$32.00
Hinge Block .703 Thick Control End	Cassette	HE10108rA	O	3	4	\$95.00
Lamp Module 24VDC White	Control Panel	LAMP-MODULE-1009	O	3	4	\$38.00
Meter Digital 24 VDC	Control Panel	METER-DC-1016	E	6	4	\$305.00
Relay, 2 Pole 24VDC	Control Panel	RELAY-2P-24VDC-01	E	3	4	\$12.00
Variable Drive 1HP 480V	Control Panel	VFD-1HP-480V-1001	E	3	4	\$365.00
GEARMOTOR, 1/3HP, 5:1, 380V-3-50	Drive	GEARMOTOR-0023	E	1	4	\$475.00
GEARMOTOR, 1/3HP, 80:1, 380V-3-50	Drive	GEARMOTOR-0022	E	3	4	\$1,500.00
RF 06 Roll 1.5M	Feeder	HE10036	E	1	10	\$1,875.00
Bearing for Idler roll 1.0 OD	Idler Roll	BEARING-0004	O	18	4	\$18.00
Idler Roll 1.5M	Idler Roll	G000186rG	E	1	8	\$1,925.00
IONIZER BAR 156 OAL, 144CM EFF, NO CABLE EI-VSA IONIZING BAR	Ionizer	IONIZER-BAR-0008	S	1	8	\$1,785.00
CABLE IONIZER 1.5M 90DEG & STRAIGHT CONS	Ionizer	IONIZER-CABLE-TYPE1	S	1	8	\$215.00
POWER SUPPLY IONIZER 115/50/60 2 CONNS	Ionizer	XFMR-IONIZER-03	S	1	14	\$640.00

Prices quoted based on Ex works, in USD and exclude government taxes if applicable.

Prices valid for 60 days from date of issue.
 Please quote Outotec Part No. on all correspondence.

Legend - Category of Spares

- Commissioning = Spares that may be required during the installation and startup period = C
- Operational/Consumable = Components that may require replacement during normal operation = O
- Emergency/Insurance = Long lead delivery components that may compromise operation = E
- Strategic/Capital = Capital investment, probable long lead delivery = S

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North American Service Centre

Outotec

Minerals Processing, Physical Separation

**INSTALLATION, OPERATING,
& MAINTENANCE MANUAL**
December 2007

38 (38)

**Drawings
(Included Here)**

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