INSTRUCTION MANUAL

MiniRanger II

ULTRASONIC
LEVEL MEASURING SYSTEM

MILLTRONICS

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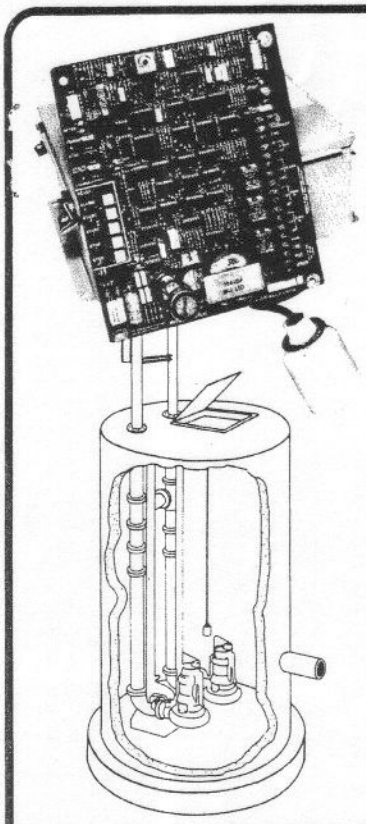
PL211



Dual Pump Controller . . .

Provides non-contacting ultrasonic level control for sewage lift stations, pump stations and storage tanks.

Features

Non-Contacting Control of Single and Duplex Pump Stations • Selectable Fixed or Alternating Lead Pump • Analog Output, Proportional to Level • High Level Alarm • Programmable Restart Delay on Power Outage • Simple Installation • Low Maintenance • Pump-Up or Pump-Down Operation

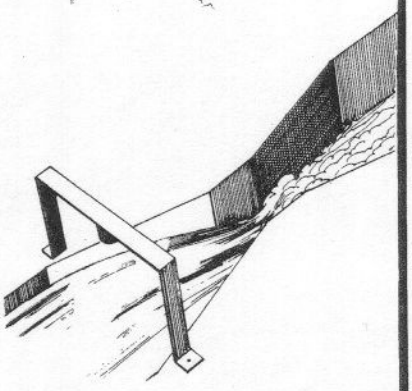
The D.P.C. is non-contacting. It is immune to: float tangles, grease build-up, matting and other maintenance inducing factors.

Open Channel Metering . . .

The Milltronics O.C.M. System is used to accurately determine the flow rate of liquids or slurry material through metering channels and can be calibrated for any engineering units such as G.P.M., M.G.P.D., or L.P.D. It's non-contacting design provides reliable maintenance-free operation because nothing comes in contact with the effluent.

With a resolution of better than 20/1000 (.5 mm) of an inch the O.C.M.'s accuracy is unsurpassed.

The O.C.M. can be easily installed and operational on your metering channel in less than 30 minutes.

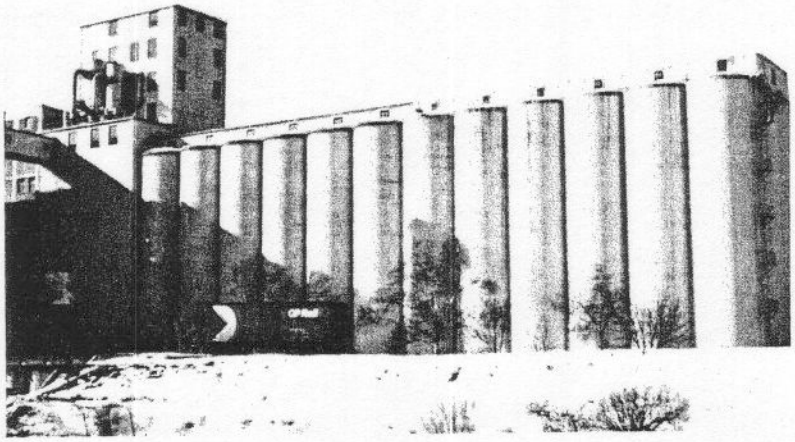


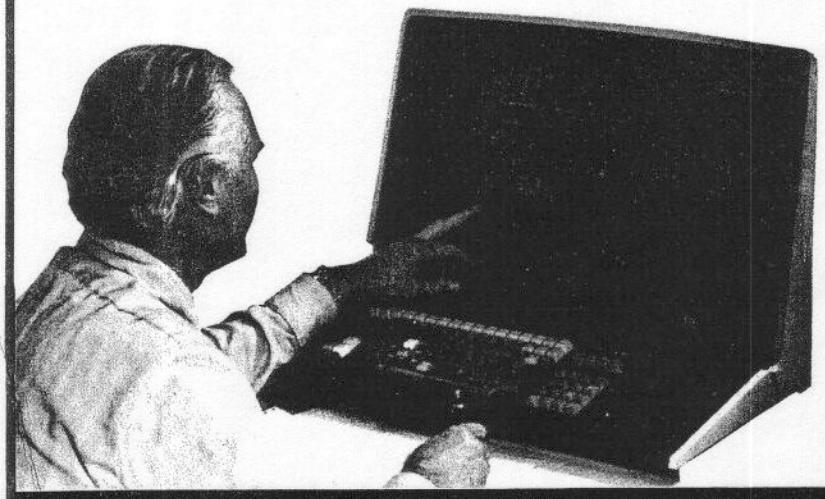
data acquisition systems

If you have from 30 to 300 or more silos and wish to know your inventory at the touch of a button, the Milltronics Data Acquisition System is for you.

Each system is engineered and programmed to your specific requirements.

The Milltronics Data Acquisition System consists of a non-contacting Ultrasonic Level Measuring System located on the silos.





The D.A. System is connected via an inexpensive 2-pair cable to a programmable control console.

Our control console provides instantaneous information regarding the level status of any of your individual or groups of silos at the touch of a button.

No system is too large.

Let us design a Data Acquisition System for you today.

MILLTRONICS

10A700/01/82

TELEPHONE
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(817) 277-3543

MILLTRONICS 730 THE KINGSWAY, PETERBOROUGH, CANADA K9J 6W6
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DRAWINGS

SECTION 1
GENERAL INFORMATION

The Milltronics Miniranger Ultrasonic Level System is an entirely solid state "package" designed to measure the level of liquids and solids in vessels up to 25 feet in depth. This system consists of only two elements: ultrasonic transducer and cabineted electronics, neither of which requires contact with the material to be measured.

The Miniranger System employs the principle of "Sonic or Echo Ranging" to determine distance. In operation, the Miniranger transducer emits an ultrasonic pulse directed at the surface of the material to be measured. The echo reflected from the material is received by the transducer, delayed in time relative to the distance it travelled. The time interval between transmitted pulse and received echo is electronically converted into an analog indication of the material level and displayed on the panel meter. An additional current or voltage output is available for operation of a recorder and/or controller.

The problem of gain adjustment or "tuning" the receiver eliminated by a sophisticated automatic gain control system. The system samples the amplitude of the return echo and programs the receiver gain to maintain a constant echo amplitude regardless of variations in target reflectivity and air path attenuation. Other provisions allow the Miniranger to accept loss of up to 75% of echo returns or complete loss of echo for 20 seconds without noticable output reading deterioration.

Empty and full adjustments allow the meter indicator and output signals to represent any 2.5 feet (or greater) increment within the total range of the instrument.

Built-in dual alarms provide fully adjustable High and Low alarm contacts. Additional dual alarm modules may be added to the System to provide as many as 6 alarm points within the span.

SECTION 2
SPECIFICATIONS

MEASURING RANGE	2 to 25 feet depending upon material
ANALOG OUTPUT	Stab Select 0-20 mA DC or 4-20 mA DC into maximum 750 ohms 0-1 mA DC for local meter
ZERO & SPAN	Non-interacting, individually adjustable for any 2.5 Ft. (.75M) span throughout the range of 2 to 25 Ft. (.6 to 7.6M)
REPEATABILITY	Within 0.5% over a 30 day period
ACCURACY	System accuracy of better than 1% of span
TEMPERATURE COMPENSATION	Optional sensor holds output variation to within 0.01% per degree C
BLANKING	Continuously adjustable from 2 Ft. (.6M) to 6 Ft. (1.8M)
OUTPUT DAMPING	Standard, continuously adjustable
TRANSDUCER ST25	Acoustically matched, patented transducer is approved by both CSA and FM for use in Class I Groups A, B, C and D; Class II, Groups F and G locations. Drive voltage 160 Vrms at .5ms duration (90 ms between pulses)
CABLE REQUIREMENTS	Up to 600 ft.(183M) of RG62U cable between transducer and electronics.
ALARMS	1 - Failsafe High 1 - Failsafe Low Standard one high, one low fully adjustable over 0-100% of span. Each alarm has single Form 'C' S.P.D.T. contact rated 10 amps 115 VAC non-inductive LED status indicator Optional additional satellite alarm modules, to a maximum of two providing a total of six alarm points
TEMPERATURE LIMITS	Electronics -20°C to 60°C (-5 to 140°F) Transducer -40°C to 93°C (-40 to 200°F)
POWER REQUIREMENTS	115/230 V AC ± 10%, 50/60 Hz, 25 VA

ENCLOSURE	Standard Nema 4
OPTIONAL	Large Nema 4 to mount Additional Dual Alarm Module
PANEL METER	Optional 0-100% Analog Meter
WEIGHT	Transducer ST-25B -- 2 lbs (0.9 Kg) Enclosure and Electronics 20 lbs (9 Kg)

SECTION 3
INSTALLATION

1. ELECTRONIC PACKAGE

The electronic circuits of the Miniranger Ultrasonic Measuring System are contained on a single printed circuit mother board. Various enclosures are available (refer to Fig. 1 for outline and mounting dimensions).

Separate ½" conduits should be installed for the power line and transducer cable. The transducer cable must not be installed in a conduit with other wiring. Fig. 3 indicates proper terminal connections for the electronics. Note that the power input must include a good electrical ground.

Since the Miniranger is designed for continuous operation, a power switch has not been provided. If one is desired it may be included in the external power circuit.

WARNING

The power input must include a ground wire connected to a good electrical ground for proper operation of the equipment as well as for safety requirements.

2. PRE START-UP CHECKS

A. VOLTAGE PROGRAMMING

Ensure jumpers are correctly located for either 115 volts or 230 volts. (Refer to Figure 3).

B. UNIT SYNCHRONIZATION

To avoid cross talk between multiple units located in the same panel, or with common transducer runs, the units must be synchronized (they transmit simultaneously).

- Series connect terminal 1TB-5 marked "SYNC" with jumpers from unit to unit.

C. BLANKING ADJUSTMENT

Blanking potentiometer P1 is used to render the receiver inoperative and thus blind to echoes from close-in bin obstructions, up to six feet (1.8M) away. For calibration purposes this control should be fully counter clockwise (minimum blanking).

D. TEMPERATURE WIRING

If the temperature compensation probe is not being used, ensure that 9.53K ohm is connected between terminals 1TB6 and 7.

E. DAMPING SELECTION

In many cases it is desirable to have the Miniranger monitor the trend in filling by increasing the system damping rather than follow momentary target fluctuations caused by material bounce or splash. For calibration purposes adjust damping potentiometer P4 fully counter clockwise to the minimum damping position.

F. ALARM WIRING

Alarm contacts are shown in the de-energized position as though the set points were in the alarmed status.

3. **TRANSDUCER**

The ST-25 series transducers have an outer housing of chlorinated polyvinyl chloride (CPVC) and a radiating face of polyurethane. These materials have excellent resistance to a wide range of corrosives but may be damaged by ketones, aromatics and some chlorinated hydrocarbon. Alternate materials are available for these environments.

The operating range of the transducer is between -40°C to +93°C (-40°F to +200°). These temperatures must not be exceeded at the face of the transducer or permanent damage may result.

The ST-25 Transducer is generally mounted at the top of the vessel with its radiating surface aimed directly down at the surface of the material being measured. The transducer is provided with a 1" NPT nipple and isolation kit for direct attachment. See Figure 2 for transducer dimensions and typical mounting.

1. Mount the transducer at least twenty-four (24) inches above the highest level the material will reach in the vessel directly beneath the transducer. This minimum distance between material and transducer must be provided for proper operation of the system at high material level.

2. Locate the transducer as far as possible from the point the material enters the vessel to minimize interference from sonic noise generated by the incoming material and to prevent the material from falling or splattering into the sound path between the transducer and the material being measured.

SECTION 4
CALIBRATION

Before applying power to the Miniranger chassis ensure that the prestart-up checks are completed.

USE OF
DISTANCE SIMULATOR

The optional echo simulator greatly reduces calibration time, its ability to simulate bin levels allows quick calibration of output span and alarm points.

If the simulator is used, the frequency selector on the simulator should be set to 41.5 KHz. Should the Miniranger be temperature compensated remove the 9.53 K Ω resistor from terminals 1TB-6 and 7 and attach the temperature compensation element only AFTER calibration is completed to Terminals 1TB-6,7 & 8.

OUTPUT CALIBRATION

Full scale indication can be achieved for any span of 2.5ft(0.75m) or greater within the normal level range of the Miniranger. Preliminary; Turn 100% pot (P3) fully CCW and 0% pot (P2) fully clockwise.

(1) Connect a DC voltmeter, range 0-10V, from yellow test point TP4 (positive) to green test point TP5(negative).

(2) With the material level at the required full point or with corresponding DS2000 setting adjust the 100% potentiometer P3 for maximum output of 10VDC. Clockwise rotation of P3 decreases reading.

(3) With the material level at the required empty point, or with corresponding simulator setting, adjust zero potentiometer P2 for an indication of zero volts. clockwise rotation of P2 increases the reading.

(4) Repeat steps 2 and 3 above for accuracy once the span has been accurately set, it may be shifted throughout the range of the measurement by adjusting the 100% potentiometer. Do not adjust the Zero Potentiometer, it will alter the span in steps 2 and 3.

(5) The calibration is checked at the output test jacks for convenience only, setting the 0-10 volt span coincidentially established the current output 4-20 mA (or 0-20 mA).

ALARM SET POINT ADJUSTMENT

Two alarms are provided with the Miniranger, with provision for expansion to six by adding two optional satellite dual alarm modules.

To set the alarm trips first set the "NEAR" potentiometer P5, fully clockwise and the "FAR" potentiometer P6 fully counter clockwise.

With the material level or target distance at the desired set point nearest to the transducer alarm point, slowly rotate the "NEAR" potentiometer P5 counter clockwise until LED-3 extinguishes and RL-1 de-energizes. The "NEAR" alarm is now set.

With the material level or target distance at the required lower set point, slowly rotate the "FAR" potentiometer (P6) clockwise until LED-4 extinguishes and RL-2 de-energizes. The "FAR" alarm is now set.

FINAL ADJUSTMENTS

DAMPING

Rotating damping control, potentiometer P4, clockwise increases the output damping. While this slows down response it does not affect the calibration.

BLANKING

Should undesirable echoes from close-in bin obstructions be present, indicated by the output not tracking the bin cycle but holding at a fixed indication, adjust blanking potentiometer P1 clockwise to extend the blind zone past the obstruction. Note the farthest that blanking can be extended is 1.8 M (6 Ft.) from the transducer.

SECTION 5
THEORY OF OPERATION

1. GENERAL

Sound waves in the air travel at a constant speed at a given temperature and pressure. The Milltronics Miniranger Ultrasonic Level System determines the level of material in a vessel by computing the time required for a short pulse of Ultrasonic acoustical energy to travel from its transducer to the surface of the material and return. This elapsed time, directly proportional to the distance travelled, is converted to an analog voltage. By summing this voltage against an adjustable voltage representative of the height of the vessel and suitably processing the resultant voltage analog, a current analog is generated which is proportional to the level of the material being measured.

2. TRANSMITTER SECTION

Transmit and receive sequences are initiated 11 times per second by pulses from a free running oscillator Q13. 1C4 is dual one-shot flip flops that set the transmit pulse width to 0.5 millisecond and an adjustable blanking from 3 to 14 milliseconds. Blanking is necessary to render the receiver inoperative during the brief period in which the transmitter is actually operating. In other words, the receiver is "blanked" or made inoperative for a few milliseconds longer than the transmit pulse to allow the transducer to stop ringing. Once the motion within the transducer has ceased, the receiver is made operative to receive the echo returning from the material surface.

A positive signal at the emitter of Q1 allows the transmit oscillator, Q7 and T1, to generate approximately 20 cycles of high frequency (41.5K) alternating current at the secondary of T1. These oscillations are amplified by the transmit amplifier Q2, Q3, Q4, Q5 and T2. Electrical energy is coupled from the secondary of T2 to the transducer via diodes D2 and D3. The diodes will pass the outgoing high voltage transmit pulses and block the now incoming low voltage pulses thereby routing them to the receiver circuitry. Indicator L1 gives a visual indication each time the transmitter operates.

3. **RECEIVER SECTION**

Electrical signals from the transducer are coupled to the receiver input via resistor R34. Diodes D7 and D8 protect the receiver input by shunting the high voltage transmit signals to the ground. Capacitor C8 is charged to about 20 volts while the transmitter is operating. Once the transmitter is off, C8 discharges through D9, R33 and D8. By holding D8 is conduction, this circuit attenuates signals at the receiver input for the first few milliseconds after transmitting. This is done so that the receiver will not "HEAR" the last stage of the transducer ringing. Echoes which might arrive during this time period from material close to the transducer are strong enough to provide ample signals for detection even after attenuation.

The signals from the first stage amplifier Q9 are coupled by C17 to the input of the second stage amplifier IC1. IC1 is an integrated circuit amplifier whose gain is proportional to the current flowing into Pin 5.

Q8 and IC2-a provide additional stages of amplification. The gain of IC2-a is reduced to zero by Q10 during the blanking period. The output from IC2-a is resonated in the primary of T3 which in addition to the tuned characteristic of the transducer provide the required receiver tuning. The secondary of T3 feeds a voltage-doubling detector comprising C21, C22, D10 and D11. Each echo received will produce a pulse of approximately 2 to 3 volts at the detector output, test point TP2 (red).

Capacitor C23 is charged to a voltage that is representative of the receiver output pulse. This voltage is compared by IC2-b to a reference voltage set by R44 and R45. IC2-b to a reference voltage set by R44 and R45. IC2-b is connected as an integrator whose output is proportional to the time integral of difference between the reference voltage and the receiver output held by C23. In operation, the output of IC2-b programs the receiver sensitivity by automatically setting the gain for amplifier IC1, AGC test point TP3 (brown). When it is necessary, the current flowing to Pin 5 of IC1 for the receiver gain can still be adjusted through AGC potentiometer P7.

4. OUTPUT SECTION

A. TEMPERATURE COMPENSATION

In the air the speed of sound changes by about 0.17% per Celcius Degree. This phenomenon may be compensated for by altering the range reference voltage so that it also varies with temperature by 0.17% per Celsius Degree.

IC10-d is an inverting amplifier in which the temperature sensor element is a part of the gain-determining feedback circuit. The gain of the circuit is minus one (-1) at $20^{o}C$ and degreases by 0.17% per Celcius Degree above that temperature. This, at $20^{o}C$ the output voltage is P6.2 volt and at temperature above $20^{o}C$ the output voltage will be less than 6.2 volts.

The reference for range determination is the net negative current flowing away from Pin 6 of IC10-a through R93 and R100. These two currents sum to an equivalent current that would result from a single input of N6.2 volts + 0.17% per ^{0}C divided by a single input resistance of 1M ohms. Note particularly that while the output of IC10-d decreases with the temperature, the magnitude of the resultant reference to the ramp generator IC10-a increases with temperature.

B. RANGE DETERMINATION

The output from IC10-a is a linear voltage ramp which rises from 0 to P15 volts in approximately 70 milliseconds. A signal from IC4 Pin 6 discharges C49 at the beginning of each transmit-receive sequence and thus causes the ramp rise linearly from transmit time.

IC10-b is a unity gain inverter. The potentiometer P3, 100% adjustment, allows the output of IC10-a to be offset in the positive direction. Hence the output of IC10-b is some positive voltage which ramps linearly downward crossing through the zero volt level at the instant that an echo from the highest material level would return.

IC10-c inverts the ramp once more so that its output crosses zero in a positive-going direction at the same instant in time. The potentiometer P2, zero adjustment, set the rate at which the output of IC10-c rises. The rate is set so that the output reaches 10 volts at the lowest material level would return.

Two NAND gates "a" and "b" of IC3 form a flip-flop which is set and reset by the transmit pulse and echo. The output of the flip-flop opens the gate of IC6-d briefly every time an echo is received and charge C40 to the voltage that is present at the output of IC10-c at the instant of echo arrival.

In the event that no echo is received, the flip-flop will remain at the set state and the echo indicator, LED 2, will be extinguished. A high voltage will be charged through the RC network of R75 and C37. In approximately 20 seconds, the output of IC5-c will change from high to low to close the gate of IC8-a and open the gate of IC8-d: The memory indicator, LED 1, will be extinguished and the system output will go either to fail safe high or fail safe low depending on the connection of J3 or J4.

After passing through two high input impedance voltage followers, IC9-a and b, with damping adjustment, P4 and C6, the analog signal will go to the inverting summing amplifier IC11-b via resistor R111, N5 volts via resistor R110. The output of IC11-b will be 0-10 volt signal representing 0 to 100% material level. R106 coverts the 0-10 volt analog to a 0-1 mA signal suitable for driving a low impedance panel meter.

IC9-d functions as another inverting summing amplifier. In the absence of an input signal from IC11-b, a 10 volt reference signal at R88 is summed and inverted to produce a negative 4 volt output. Therefore, the summed voltage at the output of IC9-d will vary over the range of N(1-5 volts). This output is used for additional alarm modules or to drive Milltronics local LCD meter.

C. CURRENT OUTPUT

The basic function of the current output circuitry is to derive a stable current output signal, 0 - 20 mA or 4 - 20 mA, reference to common.

The overall circuitry is basically a closed loop regulating feed back system. The input signal (0 - 10 volts) and the feed back signal proportional to current flow is summed at the input of IC7-a which functions as a very high gain comparator. Any error between the two inputs will cause the output current flowing through the sensing resistor R50 to vary in the direction to reduce the error to zero. IC7-b functions as a unity gain inverter driving the level shifting circuitry consisting of Q15 and R69 which subsequently drive the current output transistor Q16.

It is noted that the output developed across R50 is not at a fixed reference. A 0 - 20 mA signal will develop a 0 - 2 volt signal across R50 which could be reference to common if the external load impedance is zero or floating voltage above common if the external load impedance is not zero (750 Ω maximum). IC9-c, a differentially connected amplifier with a very high common mode rejection ratio, ensures that the floating current signal is sensed accurately. The ratio of R91 to R92 must be the same as the ratio of R86 to R51 with the assistance of the offset potentiometer P8 (the adjustment is factory sealed).

The output current may be changed from 0 - 20 mA to 4 - 20 mA by a stab select arrangement. If the stab select is not connected, 0 - 10 volt input applied to R78 will produce a 0 - 16 mA output. Placing the stab select in the 0 - 20 mA position (J2) will put R77 in parallel with R78 and the output becomes 0 - 20 mA. Placing the stab select in the 4 - 20 mA position (J1) will connect R77 to a fixed 10 volt reference and the output becomes 4 - 20 mA.

D. ALARMS

The output of IC9-d is a negative 1-5 volt signal. This voltage is compared with a reference voltage set by "NEAR" alarm adjustment (P5) at the inputs of the comparator IC11-a. When the voltage representing material level becomes less positive (i.e. more negative) than the reference voltage, the output of IC11-a switches low, turning off Q17 and de-energizing the "NEAR" relay RL1. R116 and R117 provide a 2% hysterisis to prevent relay chatter when the material level is near the alarm point.

The "FAR" alarm operates in a similar manner except it is designed to de-energize the relay RL2 as the material level falls below the alarm set point. In this manner, both alarms are failsafe because the loss of power will cause the relays to assume their alarm condition, i.e. de-energized.

One Form-C contact arrangement is provided with each alarm. Additional alarms (optional) may be added via an alarm connector provided on the board. Each additional dual-alarm module provides <u>two</u> Form-C contact arrangement per alarm point.

A maximum of two additional alarm modules may be added to give a total of 6 alarm points within the span.

SECTION 6
MAINTENANCE

1. OPERATIONAL TROUBLESHOOTING

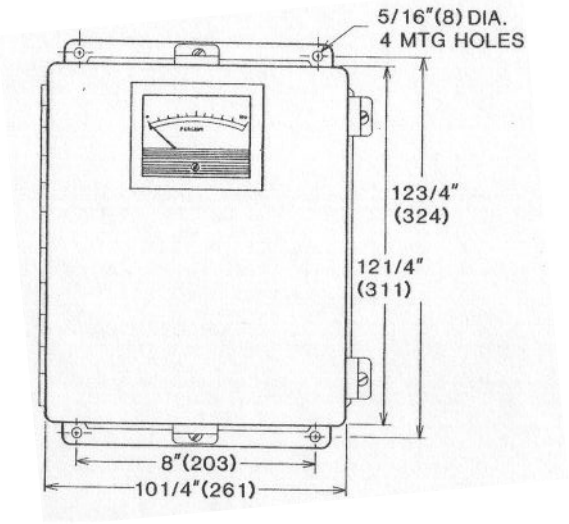
FAULT	ACTION
Transmit neon not flashing	- Check line supply voltage and power connections. - Check voltage program jumpers. - Check fuse. - Check for shorted transducer cable by lifting cable connections.
Echo processing LED extinguished	- LED 2 being extinguished indicates loss of echo. Generally this will occur only under extremely high dust condition. Relocate the transducer to a less dusty bin position. The high gain foam facings should be used. - Check if transducer foam face is saturated with moisture. This facing is not intended for a wet environment. Remove with scraper and clean off adhesive by wiping with acetone soaked cloth.
Erratic Output	- Check if material falling through transducer path, re-aim transducer. - Check continuity of transducer cable shield. - Check transducer shield is not grounded in the field. - If output bounce caused by material surface agitation increase damping. - Ensure power connection includes a ground wire.
Output Cycling	- Check that units synchronized if common transducer cable runs used. - Ensure that transducer cabling is not run with power feed.

2. MAINTENANCE

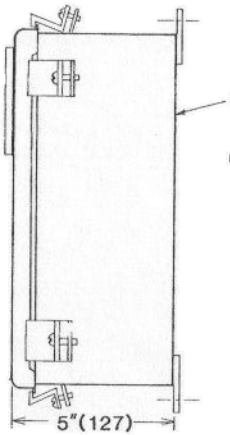
This equipment requires very little maintenance due to its solid-state circuitry. However, a program of periodic preventive maintenance should be initiated. This should include regular inspection, general cleaning, transducer face inspection, overall system performance checks, and standard good-housekeeping practices.

A periodic inspection of the transducer is recommended in some applications, at which time any build-up of material on the transducer face should be removed.

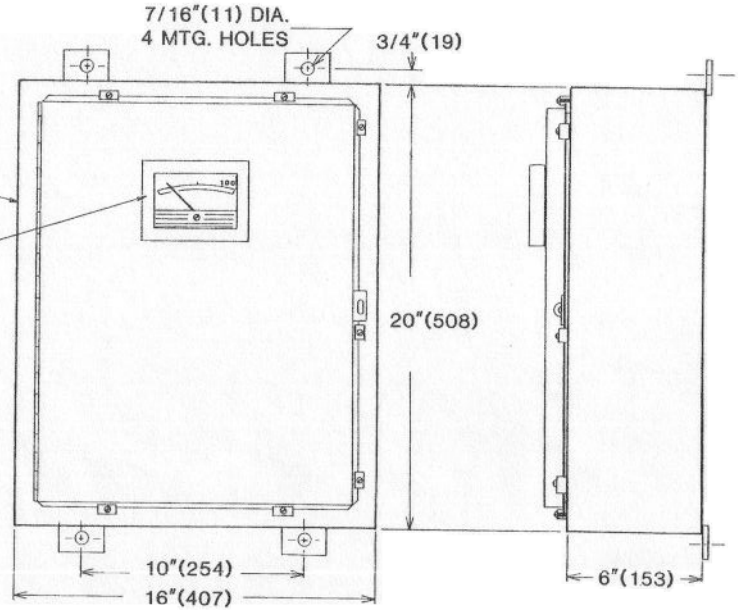
The chassis is best cleaned with a vacuum cleaner or a clean, dry cloth. Remove all layers of accumulated dust from printed-circuit board components. Check all electrical contacts for corrosion and wear.



STANDARD ENCLOSURE - NEMA 4

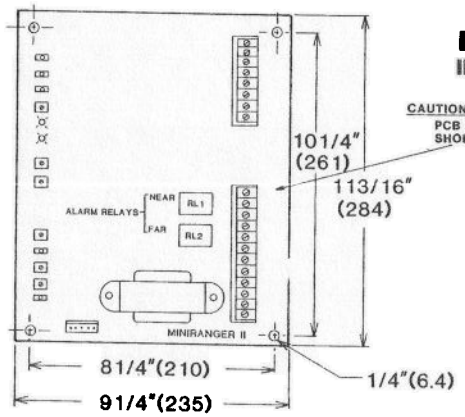


SIDE VIEW



OPTIONAL ENCLOSURE - 1418N4C6 NEMA 4

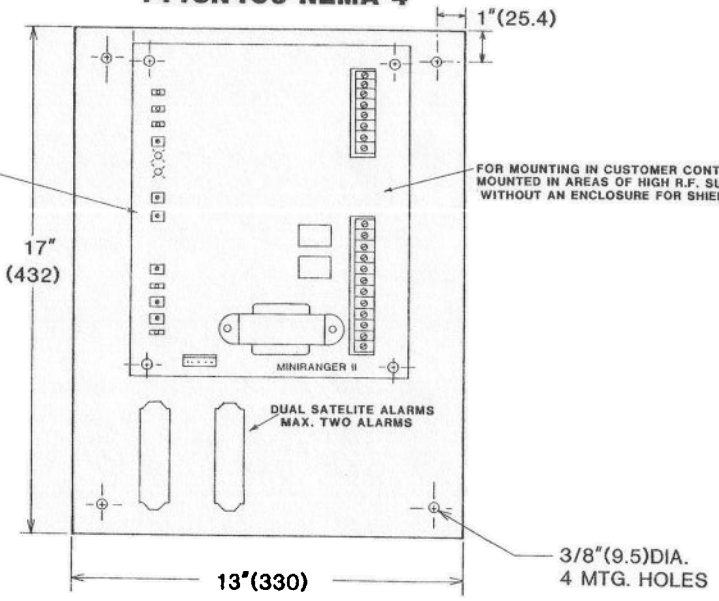
SIDE VIEW



DIMENSIONS
INCHES(MILLIMETRES)

CAUTION!
PCB MUST BE MOUNTED ON 1/2" STANDOFFS TO AVOID SHORTING BOARD COMPONENTS.

STD. UNIT 2 ALARMS



MINIRANGER II PCB BACKPANEL LAYOUT DETAIL- EXTRA ALARMS

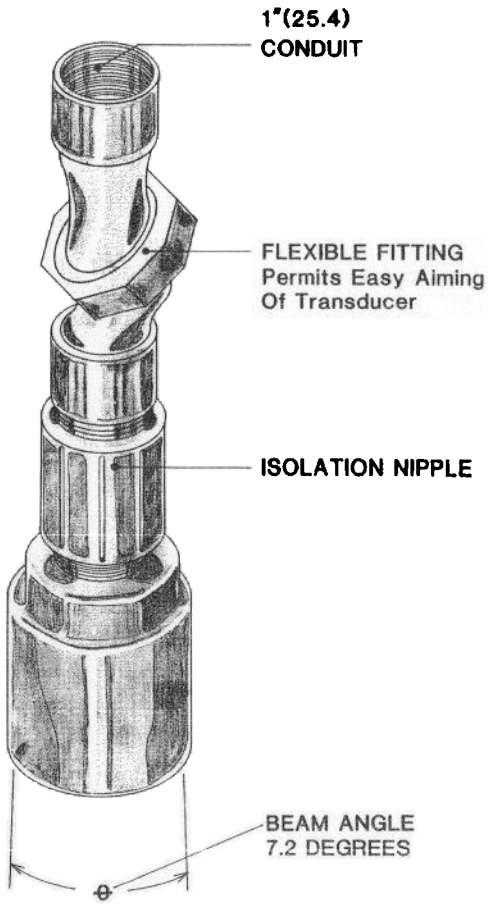
NOTES

1) BEFORE PUNCHING CONDUIT ENTRY HOLES THRU ENCL. THE PC BOARD MUST BE REMOVED TO AVOID SHORTING CIRCUIT COMPONENTS & VOIDING ANY WARRANTY CLAIMS.

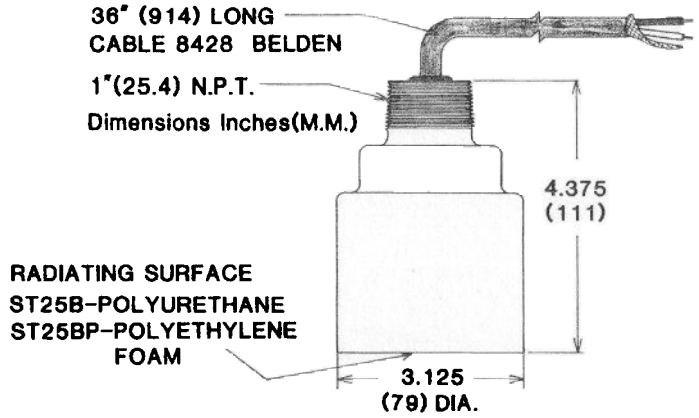
2) OPTIONAL ENCLOSURE NEMA 4 IS SUPPLIED WITH AN ANALOG METER.

FIG. 1 OUTLINE & MOUNTING DIAG.

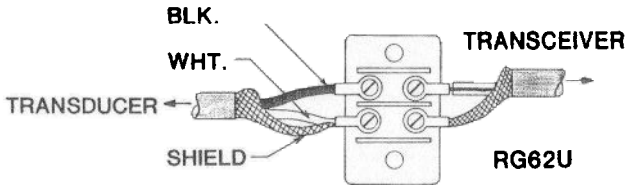
10E172 R1



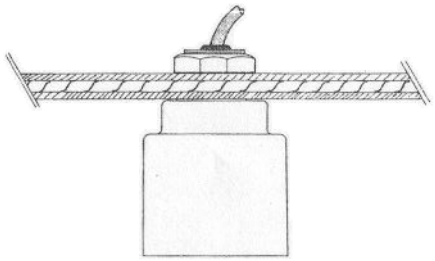
FLEXIBLE COUPLING TRANSDUCER MTG. DTL.



ST25 TRANSDUCER

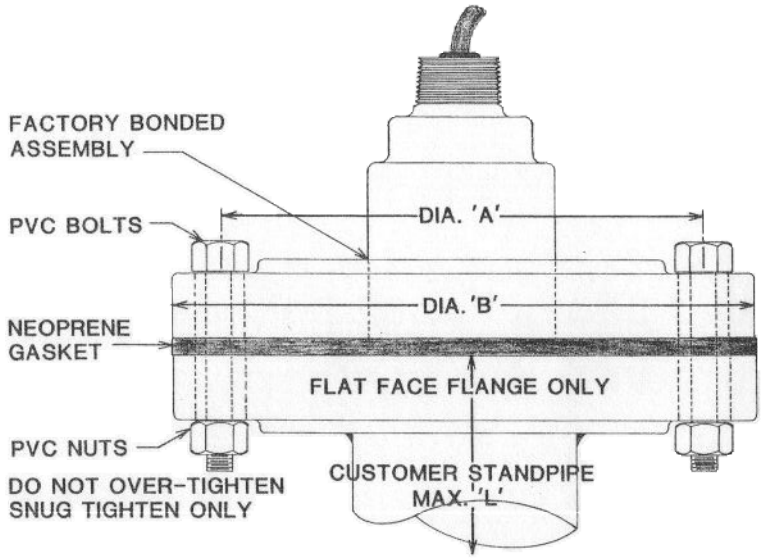


CABLE CONNECTION



PLYWOOD MOUNTING DTL.

Plywood Mount Provides Excellent Isolation



FLANGE MOUNTING TRANSDUCER DTL.

Flange Size	Dia. 'A'	Dia.'B'	Max. 'L'
3"	6"	71/2"	12"
4"	71/2"	9"	12"
6"	91/2"	11"	14"
8"	113/4"	131/2"	16"
12"	17"	19"	24"

NOTES

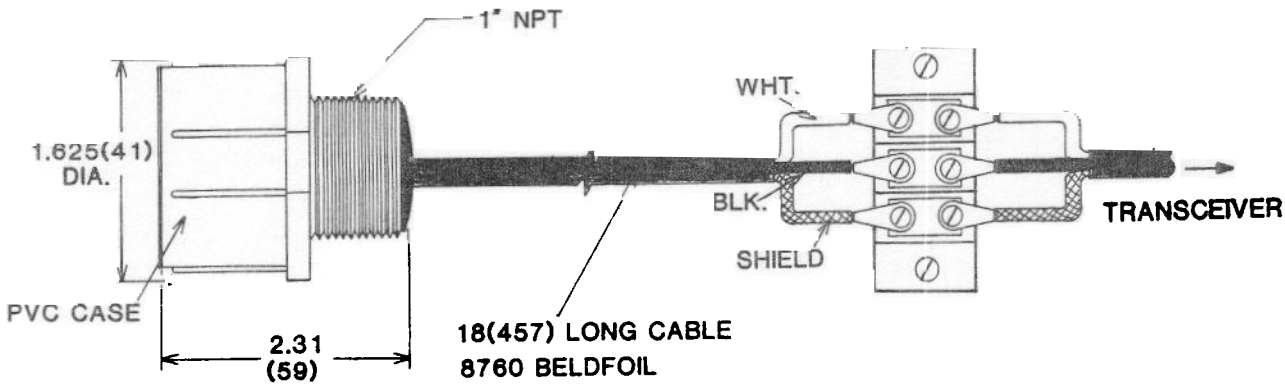
1) The PVC Female Connector & Nipple Constitute The Transducer Isolation Kit , Which Must Be Used Whenever The Transducer Is Mounted To Metal.
2) The Terminal Block Must Be Mounted In A Watertight Junction Box
   - Do Not Allow Shield To Ground At The Metal Junction Box.
   - Transducer Cable Must Be Run In a Grounded Conduit With No Other Electrical Circuit.
3) The Neoprene Gasket & PVC Nuts / Bolts (Supplied With Unit) Must Be Used To Isolate The Transducer From The Metal Standpipe
4) The ST25 Series Transducer Are CSA Approved For CLASS I GROUPS A,B,C&D CLASS II GROUPS F&G / FM Approved For Class I DIV 1 GROUPS A,B,C&D / CLASS II DIV 1 GROUPS E,F&G

FIG. 2 TRANSDUCER INSTALLATION

10D560 R0

TEMPERATURE SENSOR

TERMINAL STRIP



DIMENSIONS-INCHES (MILLIMETRES)

CSA CERTIFIED CLASS 1 GROUPS A,B,C&D : CLASS II GROUPS F&G

NOTES

1) THE TEMPERATURE SENSOR SHOULD BE MOUNTED IN A LOCATION WHICH REPRESENTS THE TEMPERATURE FLUCTUATIONS LIKELY TO OCCUR BETWEEN THE TRANSDUCER AND TARGET

2) TO AVOID FALSE INDICATION MOUNT THE TEMP. SENSOR OUT OF DIRECT SUNLIGHT RADIANT HEATING CAN CAUSE A DIFFERENTIAL OF 20 DEGREES C BETWEEN SENSOR AND AIR TEMP.

3) FOR CALIBRATION & IF TEMP. SENSOR IS NOT USED A 9.53K OHM RESISTOR MUST BE CONNECTED ACROSS TERMINAL BLOCK POINTS 6 & 7

4) THE TEMP. SENSOR CABLE BELDFOIL 8760 CAN BE RUN WITH THE TRANSDUCER CABLE IN A GROUNDED CONDUIT WITH NO OTHER ELECTRICAL CIRCUITS

5) IF THE TEMPERATURE COMPENSATION IS NOT USED THE EXPECTED ERROR DUE TO TEMPERATURE VARIATIONS IS 0.17% PER CELSIUS DEGREES (° C) OVER OPERATING RANGE.

FIG. 3 TEMPERATURE COMPENSATION OUTLINE & WIRING DIAG.

10C987/1

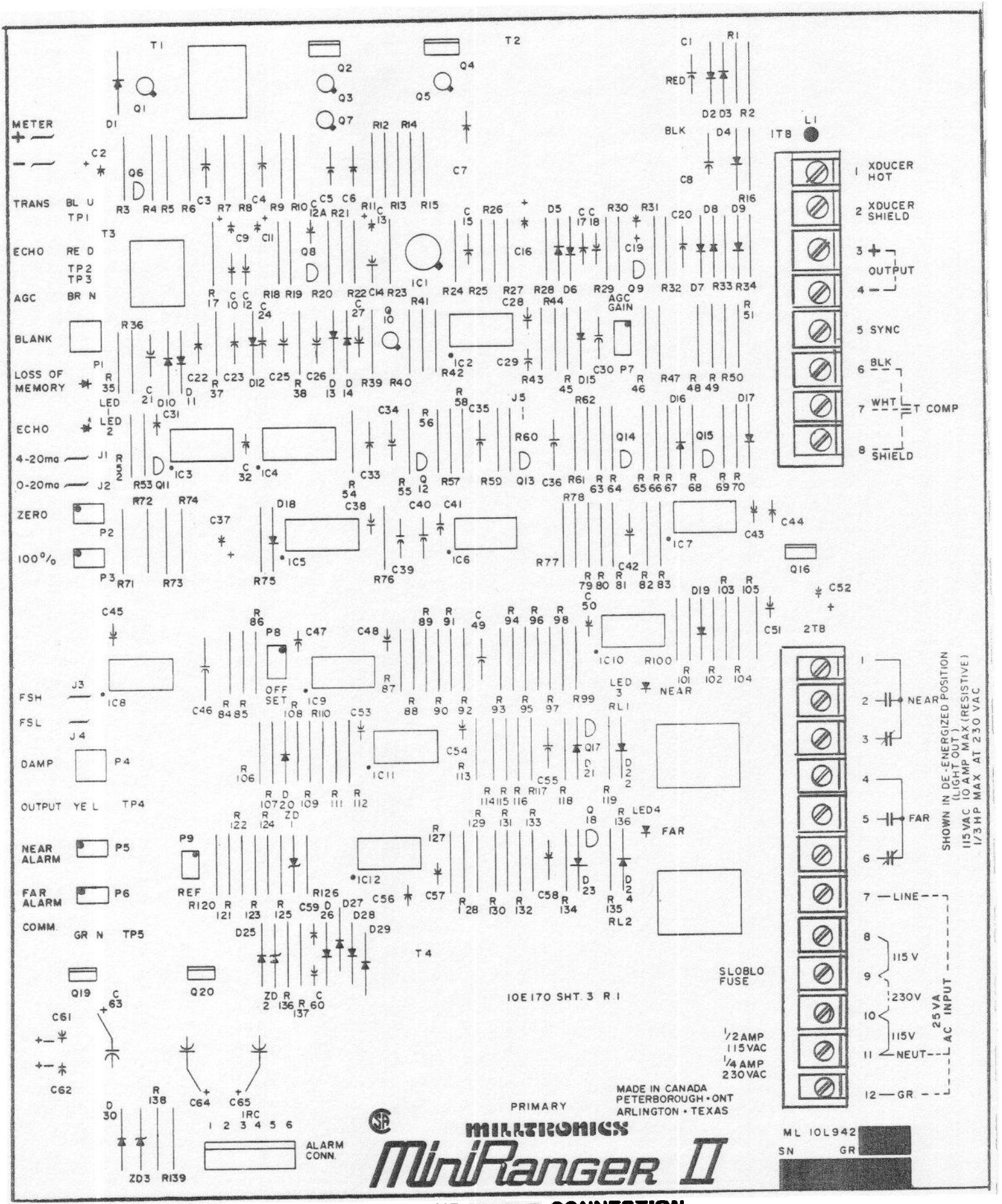
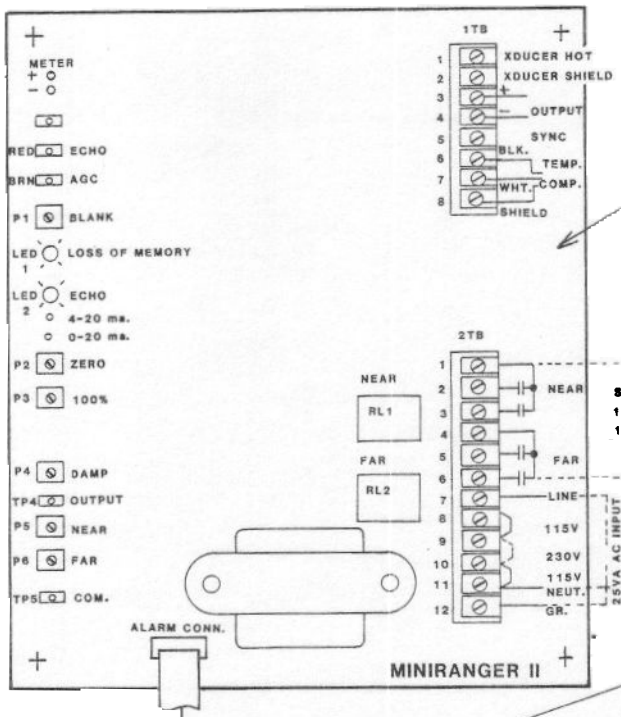
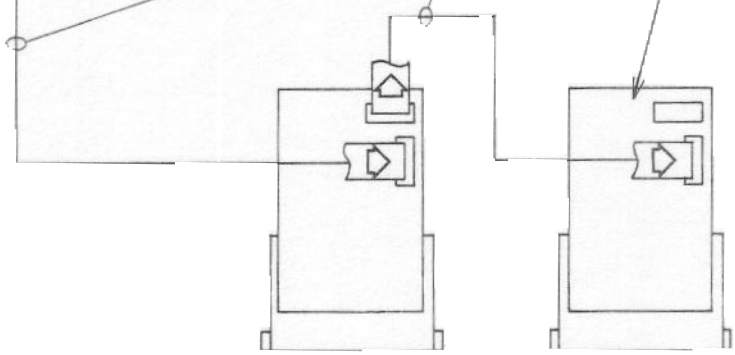


FIG. 4 OUTLINE AND CABLE CONNECTION

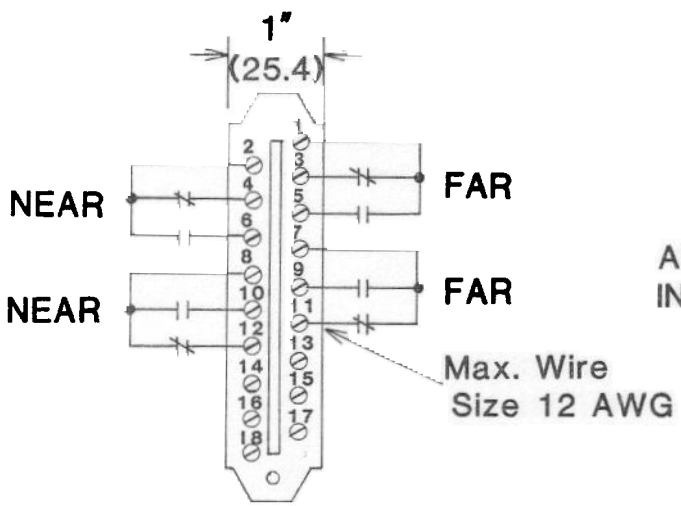


MINIRANGER II
Is Equipped With Two Alarms (High &Low) As Standard

Satelite Alarm Module C/W Umbilical Cable Assembly (Max. Of 2 Dual Alarm Modules Available For A TOTAL Of 6 Alarm Settings)

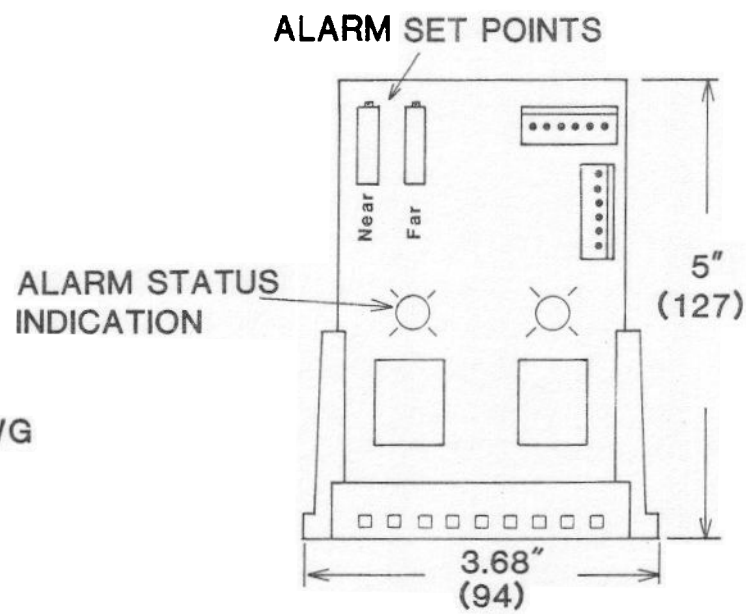


DIMENSIONS - INCHES(MILLIMETRES)



Contacts Shown In Alarm Condition:Relay De-energized

DUAL ALARM TERMINAL BLOCK



DUAL ALARM PCB OUTLINE

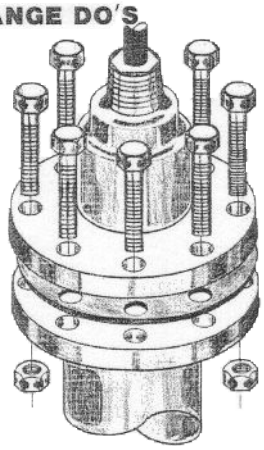
FIG.5) SATELITE ALARM OUTLINE & EXTERNAL CONNECTION DIAG.

10C961

98 PERCENT OF DIFFICULTIES ENCOUNTERED ARE DUE TO POOR TRANSDUCER LOCATION

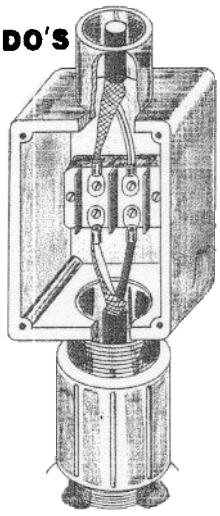
INSTALLATION

1) FLANGE DO'S



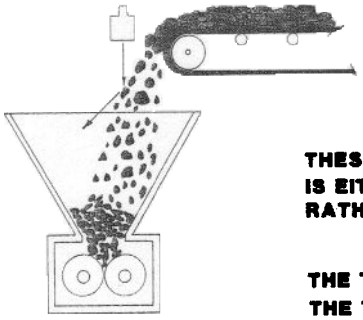
- Ensure The Standpipe Diameter Is At Least That Shown In Table On Figure 2 Transducer Installation Diagram
- Ensure The PVC Nuts , Bolts & Neoprene Gasket Are Used With The Flange
- Ensure Standpipe Construction Is Weld Neck Or Similar. Lap joint (LJ) Flanges Are Not Suitable

2) WIRING DO'S



- Tape The Shield At Junction Box TO Stop Ground Loops
- Connect The Transducer Shield
- Connect The Hydro Ground At The Transceiver
- Run The Transducer Cable In a Separate Conduit From Any Power Wiring
- Synchronize Units If Their Transducer Cables Are In The Same Conduit

POOR LOCATIONS



THESE ARE EXAMPLES OF POOR LOCATION WHERE THE ECHO IS EITHER LOST OR THE UNIT RESPONDS TO AN OBSTRUCTION RATHER THAN THE MATERIAL LEVEL

THE TRANSDUCER MUST HAVE AN UNOBSTRUCTED VIEW OF THE TARGET TO OPERATE RELIABLY

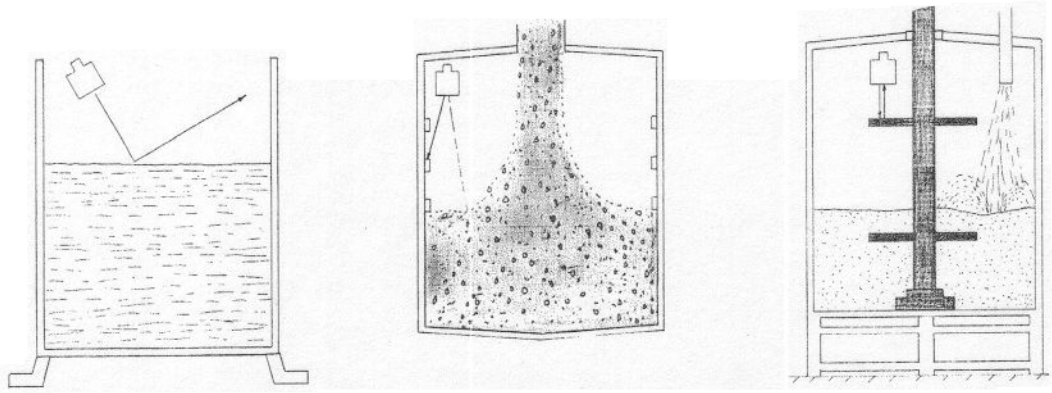
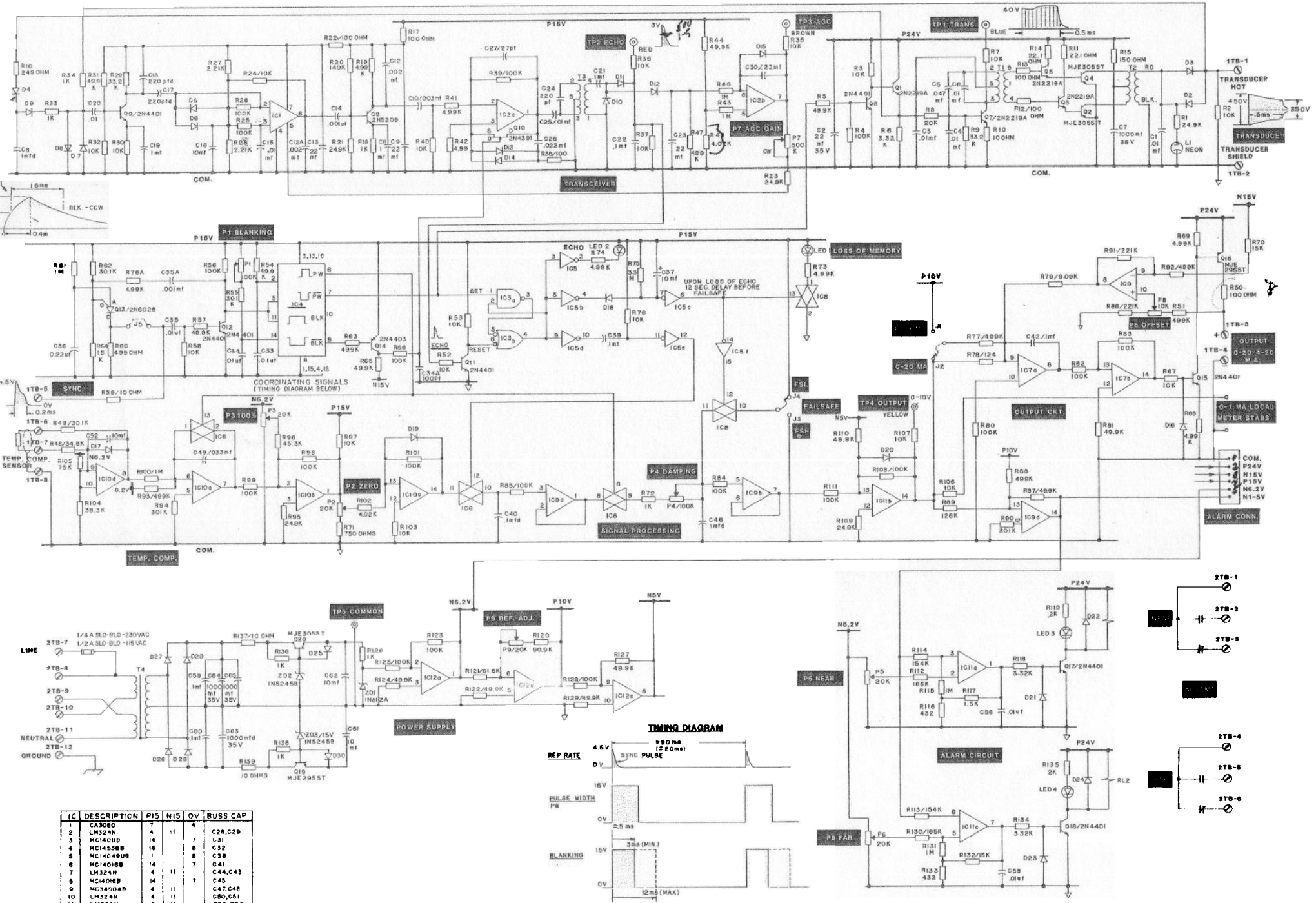


FIG. 6 SYSTEM DO'S &DONT'S

100579 RO



IC	DESCRIPTION	P15	N15	OV	BUSS CAP
1	CA3080	7		4	
2	LM324N	4	11		C28,C29
3	MC1401B	14		7	C31
4	MC1455B	16		8	C32
5	MC14049UB	1		8	C38
6	MC1401B	14		7	C41
7	LM324N	4	11		C44,C43
8	MC1401B	14		7	C45
9	MC34004B	4	11		C47,C48
10	LM324N	4	11		C50,C51
11	LM324N	4	11		C53,C54
12	LM324N	4	11		C56,C57

FIG.7) MINI II ELEMENTARY DIAGRAM

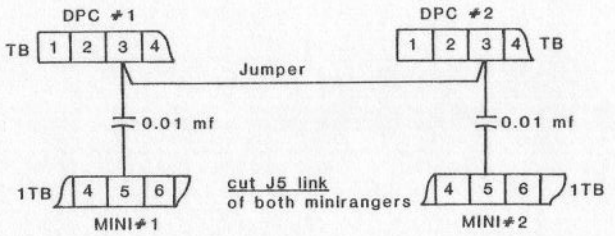
SYNCHRONIZATION CHART
for Ultrasonic Level Measuring Systems

LEVEL GENIE	Jumper together all level genie's via their TB-10						
MICRORANGER	-Use genie as master -Cut J1 link of micro -Connect 1TB-3 of micro to TB-10 of genie thru .01 mf cap.	Jumper together all micro's via their 1TB-3					
DUAL PUMP CONTROLLER	Jumper together all TB-10 of genie's and TB-3 of DPC's	-Use DPC as master -Cut J1 link of micro -Connect 1TB-3 of micro to TB-3 of DPC thru .01 mf cap.	Jumper together all DPC's via their TB-3				
OCM or ACCURANGER	Jumper together all TB-10 of genie's and TB-16 of OCM's	-Use OCM as master -Cut J1 link of micro -Connect 1TB-3 of micro to TB-16 of OCM thru .01 mf cap.	Jumper together all TB-16 of OCM and TB-3 of DPC	Jumper together all OCM's via their TB-16			
MINIRANGER II	-Use genie as master -Cut J5 link of mini -Connect 1TB-5 of mini to TB-10 of level genie thru.01 mf cap.	Jumper together all 1TB-5 of mini's and 1TB-3 of micro's	-Use DPC as master -Cut J5 link of mini -Connect 1TB-5 of mini to TB-3 of DPC thru .01 mf cap.	-Use OCM as master -Cut J5 link of mini -Connect 1TB-5 of mini to TB-16 of OCM thru .01 mf cap.	Jumper together all mini's via their 1TB-5		
MIDRANGER II	NOT APPLICABLE	-Use mid as master -Cut J1 link of micro -Connect 1TB-3 of micro to TB1-7 of mid thru .01 mf cap.	NOT APPLICABLE	NOT APPLICABLE	-Use mid as master -Cut J5 link of mini -Connect 1TB-5 of mini to TB1-7 of mid thru .01 mf cap.	Jumper together all mid's via their TB1-6, TB1-7 and TB1-8	
AIRANGER III	-Use genie as master -Cut air III sync link -Connect TB702-5 of air III to TB-10 of genie thru .01 mf cap.	-Use air III as master -Cut J1 link of micro -Connect 1TB-3 of micro to TB702-5 of air III thru .01 mf cap.	-Use DPC as master -Cut sync link of air III -Connect TB702-5 of air III to TB-3 of DPC thru .01 mf cap.	-Use OCM as master -Cut sync link of air III -Connect TB702-5 of air III to TB-16 of OCM thru .01 mf cap.	-Use air III as master -Cut J5 link of mini -Connect 1TB-5 of mini to TB702-5 of air III thru .01 mf cap.	-Use mid as master -Cut sync link of air III -Connect TB702-5 of air III to TB1-7 of mid thru .01 mf cap.	-Use one air III as master -Cut sync link of others -Jumper together all TB702-5's
	LEVEL GENIE	MICRORANGER	DUAL PUMP CONTROLLER	OCM or ACCURANGER	MINIRANGER II	MIDRANGER II	AIRANGER III

NOTES

1-IF ANY UNIT IS TAKEN OUT OF SERVICE ITS SYNC.CONNECTION SHOULD BE REMOVED
2-AIRANGER III RANGE WILL BE REDUCED WHEN IT IS SYNCHRONIZED BY OTHER UNITS WITH SHORTER RANGE
FOR EXAMPLE, WITH LEVEL GENIE, AIRANGER RANGE WILL BE DOWN TO APPROX. 50FT DUE TO LEVEL GENIE REP. RATE OF 90 MSEC
3-0.01 mf CAPACITOR CAN BE REPLACED BY SMALLER VALUE(4700 pf) OR HIGHER VALUE(0.022 mf) WITHOUT EFFECTING SYNC. SYSTEM
4-TYPICAL EXAMPLE :

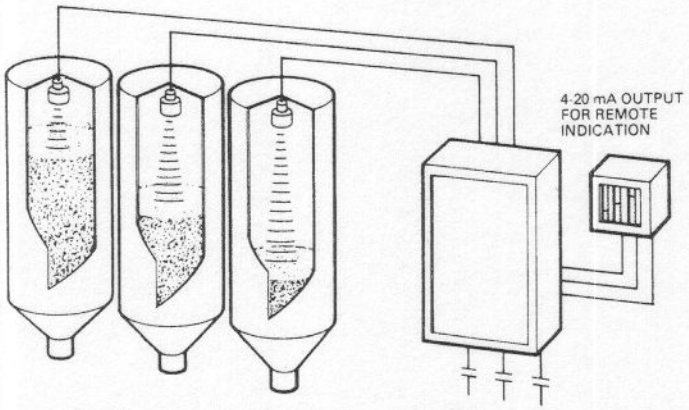
Two Dual Pump Controllers & Two Minirangers



10D648

scanner systems

If you have numerous tanks or silos and wish a cost efficient system to monitor their levels, the Milltronics Level Scanner System is for you.
The system is designed around the AiRanger III Transceiver to offer maximum flexibility.



AUTO SCANNING SYSTEMS

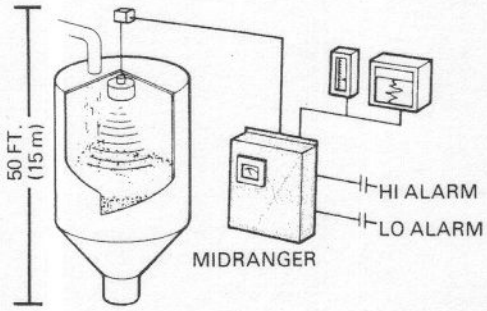
INDIVIDUAL ALARMS FOR
EACH SCANNED POINT

The key features are:

- Fifteen point capability; with up to 4 alarm trips per point
- Up to 4 Level Scanners can be handled by AiRanger III Transceiver (providing the potential for a 60 point system)
- Separate gain programming for each point
- Drift free digital memory
- Fail-safe alarms
- L.E.D. scan-position and alarm status indicators
- State-of-the-art digital technology
- Input/Output resolution of 0.3%

As your needs grow, the system can be expanded as easily as plugging in a circuit board. These features, plus Milltronics proven reliability, make the Level Scanner system your only choice.

MidRanger



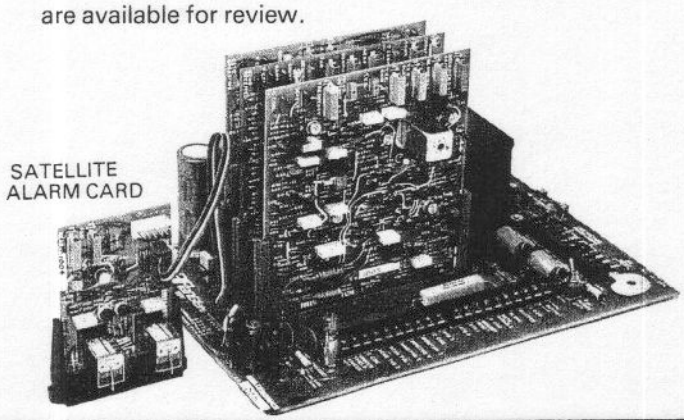
FOR MEDIUM RANGES

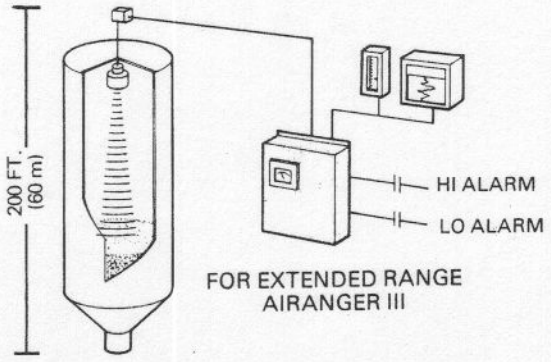
Designed to solve your level measuring problems in the 3 to 70 ft. (.9 m to 21 m) range. The MidRanger is highly reliable because it has no moving parts — no reflectors — no preamplifiers. The MidRanger incorporates temperature compensation circuitry for precision accuracy, and a 3½ digit L.C.D. meter for exact indication of level. The MidRanger's unique Dynamic Gain Programming (D.G.P.) concept provides the first truly "Hands-Off" level measurement system.
Our MidRanger provides more of what you really need to solve your level measuring problems.
MidRanger is the solution!

AiRanger III

Milltronics AiRanger III Transceiver is by far the most advanced unit available today. The completion of comparison tests by independent consultants, has again proven the superiority of our transceiver. Actual installations, with operating parameters to 200 feet (60 m), are available for review.

The ability to "lock on" to actual material level within the bin, tank or silo, while it is being filled, and provide an analog signal proportional to this level for recording or control purposes has helped make Milltronics the number one ultrasonic level measuring company in the world.





FOR EXTENDED RANGE
AIRANGER III

MILLTRONICS

10A701/01/82

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