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Manufacturer
TLV CO., LTD.
Kakogawa, Japan
is approved by LRQA Ltd. to ISO 9001/14001

EAC

TLV®

Instruction Manual

Steam Trap Management System

TrapMan®

Diagnostic Unit

TM5N (Standard Model)
TM5N-EX (ATEX/IECEx/UKEX Certified Model)

(Type P)

Important: In order for the unit to perform highly accurate diagnosis, periodic maintenance (function check) is necessary. A warning will be displayed on screen when periodic maintenance is due (when the preassigned date for maintenance is reached. ex: after 2 years). Please contact TLV at this time to request maintenance.
If maintenance is not carried out, the unit will be automatically locked.
For details see 1.1 Periodic Required Maintenance.

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Introduction

Thank you for adopting the TLV TrapMan steam trap management system.

This product has been thoroughly inspected before being shipped from the factory. When the unit is delivered, before doing anything else, please check the specifications and external appearance to make sure that all components have been received and there is no obvious shipping damage. Also be sure to read this manual carefully before use and follow the instructions to be sure of using the unit properly. This manual should also be consulted during maintenance and troubleshooting.

Hereinafter, the TM5N and TM5N-EX will be referred to as “TM”.

1. Read Carefully Before Use

1.1 Periodic Required Maintenance

In order for TM to perform highly accurate diagnosis, a periodic function check is necessary. TM will use the following graded alert system to remind users of the upcoming scheduled maintenance. When one of the following alerts is displayed on screen, as soon as possible, bring the unit to the nearest TLV representative, or contact TLV for further information.

1. The TM begins counting when you turn on the power for the first time (or after completion of maintenance), and when the 2 years until the required maintenance plus a 3 month grace period have passed, the unit will be locked.

   DAYS UNTIL REQ.
   MAINTENANCE: XXX

   Starting 3 months before the next scheduled maintenance, a message showing the number of days left until required maintenance, will be displayed every time the unit is turned on.

   Press ENT to continue with normal operation.

2. If the scheduled date for maintenance has passed and maintenance still has not been carried out, for a further 3 months a message will be displayed showing the number of days that maintenance is overdue and the number of days until the TM unit becomes locked.

   MAINT OVERDU: YYY
   DAYS TO LOCK: ZZZ

   Press ENT to continue with normal operation.

3. If maintenance is not carried out before the lock date (2 years and 3 months from first power-on), a message will be displayed stating that the unit is currently locked.

   MAINT OVERDU: YYY
   UNIT LOCKED

   When the unit is locked you will only be able to:
   Turn the power ON/OFF,
   Turn the light on or off,
   Transfer data to and from the TrapManager software.
   All other functions will be unavailable.

1.2 Safety Considerations

Read this section carefully and follow the instructions to ensure proper use of the unit.

The precautions listed in this manual are designed to ensure safety and prevent personal injury to yourself and others as well as equipment damage. For situations that may occur as a result of erroneous handling, three different types of cautionary items are used to indicate the degree of urgency and the scale of potential danger and damage: **DANGER**, **WARNING** and **CAUTION**. All three types of cautionary items are important for safety; be sure to observe all of them.

Symbols

	**Indicates a DANGER, WARNING or CAUTION item.**
 **DANGER**	Indicates an urgent situation which poses a threat of death or serious injury
 **WARNING**	Indicates that there is a potential threat of death or serious injury
 **CAUTION**	Indicates that there is a possibility of injury or equipment/product damage

1.3 Safety Precautions

1.3.1 Charging Precautions

WARNING

1. Do NOT charge with other than specific incoming voltage (Ui: 4.5 V) and current (Ii: 300 mA).
   Charging with other than specific incoming voltage (Ui: 4.5 V) and current (Ii: 300 mA) may result in fire, damage to the unit or electrical shock.

2. Use only a standard commercial power source.
   Do NOT use this charger with other than a standard commercial power source. This may result in fire or unit failure.

3. Do NOT operate with wet hands.
   Do not connect or remove the charger with wet hands. This may result in electric shock.

4. Do NOT use the charger in explosion hazard areas.
   The charger is not intrinsically safe. Do NOT use in explosion hazard areas.

5. Be careful when handling the charger cord.
   Do NOT damage it by bending it, binding it or pulling it excessively. Also do NOT place objects on top of the cord or allow it to contact hot objects, as this may result in fire or electrical shock.

6. Handling the charger.
   When removing the charger from the electrical outlet, grasp the body of the AC adapter. Do NOT pull on the cord, as this may damage the cord and result in fire or electric shock.

7. Do NOT leave the charger (AC adapter) plugged in after charging is complete.
   Once main charging is complete and the charger has switched to trickle charging, make sure to unplug the AC adapter, as failure to do so may result in heat generation or fire.

8. Do NOT use the charger with other devices
   This charger is designed for use only with the TM. Use with other than its intended device may result in heat generation or fire.

1.3.2 Battery precautions

WARNING

1. Do NOT attempt to dismantle the battery.
   Do NOT attempt to disassemble the battery under any circumstances. Battery fluid leakage may cause injury to the skin or damage to clothing.
2. Use only eneloop AAA batteries.
   For the TM5N-EX (intrinsically safe), use only SANYO HR-4UTGB or Panasonic BK-4MCC (eneloop AAA) batteries.
   Do NOT use any other batteries than those specified, as this may result in fire or injury.
3. Do NOT dispose of batteries by burning.
   Whether batteries are new or used, do NOT dispose of them by tossing them into a fire, as they may EXPLODE causing injury.
4. Do NOT attempt to remove/replace batteries in explosion hazard areas.
   Including TM5N-EX (intrinsically safe), remove/replace batteries somewhere other than explosion hazard areas. Failure to observe this warning may result in explosion, fire or injury.
5. At time of replacement, exchange all batteries for new.
   Mixture of new and old batteries may lead to improper operation of the unit.

1.3.3 Precautions for site inspections

WARNING

1. When operating the unit, make sure you are stationary and in a safe location out of traffic and clear of operating equipment.
   Do NOT operate the unit while you are walking around.
2. Take measures to prevent getting caught in rotating machinery.
   When passing by or working near rotating machinery, take measures to prevent the strap, earphone cord, clothing etc. from getting caught in the machinery. This may result in accident or injury and damage to the unit or equipment.
3. Take measures to prevent burns during use.
   Wear insulated gloves and protective clothing or take other measures to make sure you will not be burned even if you happen to touch one of the hot pipes.
4. Make sure to lower the volume of the earphone before use.
   Using the earphone in places where there is loud noise or vibrations may result in hearing loss (earphones not available for TM5N-EX).

1.3.4 Other precautions

The main battery of TM may be replaced by the customer. Since the main battery is **recyclable**, dispose of it in an environmentally friendly manner and according to local regulations.

For the backup battery, return unit to TLV for replacement.

Including TM5N-EX (intrinsically safe), remove/replace batteries somewhere other than explosion hazard areas.

WARNING

1. Do NOT attempt to disassemble or modify the unit.
   Do NOT attempt to disassemble or modify the body, probe, coiled cord, etc. This may result in fire or unit failure.
2. Make sure no foreign matter gets inside the unit.
   In areas with a great deal of metal powder or other fine foreign matter, take measures to prevent this foreign matter from getting inside the unit. This may result in fire or unit failure.
3. Do NOT transfer data between the TM and PC in an explosion hazard area.
   Do NOT transfer data between the TM and PC in an explosion hazard area. This may result in explosion or fire.
4. Do NOT remove the leather case (case name: TM5N-LC-EX) while in a hazardous location.
   The TM5N-EX (intrinsically safe) is approved for use in hazardous locations only while inserted in its case.
5. Do not wipe/rub the surfaces of this product with a dry cloth etc. There is the danger of electrostatically charging the unit, which may result in fire or explosions, especially in explosion hazard areas.
   The maximum measured capacitance from the probe receptacle to ground is 14.3pF.
   The user shall determine suitability in the specific application.

1.4 Precautions for Use and Storage

1. The TM5N is not intrinsically safe.
   Use only the TM5N-EX in hazardous areas where intrinsically safe equipment is required.

   The TM5N-EX is approved for use in hazardous locations only while inserted in its leather case (case name: TM5N-LC-EX). Do not remove the case while in a hazardous location. Product markings are provided on the product enclosure beneath the leather case. For hazardous areas, the TM5N-EX should be used by trained personnel with knowledge of the hazardous locations/classifications.
   The TM5N-EX meets the following standards for intrinsic safety:

   ATEX: CE2776 ⟨Ex⟩II2G E**x** ib IIB T3 Gb DEMKO 12 ATEX 1212672X
   EN IEC 60079-0:2018, EN 60079-11:2012

   IECEx: E**x** ib IIB T3 Gb IECEx UL 12.0016X
   IEC 60079-0, 7th Edition, IEC 60079-11, 6th Edition

   UKEX: Ex ib IIB T3 Gb CML 21UKEX2641X
   BS EN IEC60079-0:2018, BS EN 60079-11:2012

   Do not wipe/rub the surfaces of this product with a dry cloth etc. There is the danger of electrostatically charging the unit, which may result in fire or explosions, especially in explosion hazard areas.
   The maximum measured capacitance from the probe receptacle to ground is 14.3pF.
   The user shall determine suitability in the specific application.

2. The range of measurement for surface temperatures is 0 to 350 °C (32 to 662 °F). Measuring objects whose surface temperature exceeds 350 °C (662 °F) may damage the tip of the probe and the internal components. Do not measure the object if you suspect that its surface temperature may exceed 350 °C (662 °F).

3. Do NOT drop or cause shocks to the unit.
   Do NOT drop the unit or knock it about or otherwise subject it to strong impacts.

4. Do NOT leave unit in hot locations
   Do NOT leave the unit where it will be exposed to direct sunlight or in areas that will become very hot; such as in cars, near heating equipment, etc. This may cause the unit to malfunction or fail.

5. Do NOT use ball-point pens or other sharp instruments to operate the keys.
   This may damage the keys.

6. Do NOT place any part of the unit other than the tip of the probe against a hot location.

7. Do NOT slide the tip of the probe against the object being measured.

8. Be careful of dust and vibration.
   Do NOT leave the unit in places subject to excessive dust and strong vibrations. This may result in failure.

9. Do NOT remove the temperature sensor from the tip of the probe.
   Trying to pull it out with excessive force will result in failure.

1.5 Steam Traps that cannot be Evaluated

Although more than 1,000 trap models can be tested with TM, those that operate under the following conditions cannot be evaluated:

1. Steam traps that are affected by high velocity steam flow noise.
    a. Trap for TLV-COSPECT
    (Pressure reducing and control valve with built-in separator and steam trap)
    b. Trap for TLV-DC3S
    (Cyclone separator with built-in steam trap)
    c. Drip leg applications at pressure reducing stations and turbines.
2. Steam traps for very high pressures (greater than 80.0 kg/cm^2 or 999 psi) and temperatures (greater than 350 °C or 662 °F).
    a. Drip leg applications on high pressure boiler steam mains.
    b. High temperature heat exchangers and reactor vessels.
    (When these traps are to be inspected, manually input the results from other measurement methods. Average leak levels will be used for steam loss calculations).
3. High capacity steam traps with condensate discharge of more than 3,000 kg/hour or 6,600 lb/hr.
    a. Large process equipment (heat exchangers, tank coils, etc.)
4. Steam traps that are used below 0.5 kg/cm^{2}G (7 psig), or with differential pressures less than 0.5 kg/cm^2 (7 psi); due to low ultrasonic wave frequencies of low velocity leaking steam.

CAUTION

Some steam traps and products incorporating built-in steam traps are registered in TrapMan, even though they cannot be judged properly due to the conditions stated above.

These models are registered for management purposes.

2. Functions and Features

Makes it possible for anyone to analyze steam traps easily

Measurement starts automatically as soon as the tip of the probe is pressed against the measurement point. After about 15 seconds, measurement stops automatically and the data is stored. After measurement is complete, the TM makes a judgement automatically.

No handwritten notation is necessary at the site

Information about the operating and ambient conditions needed for steam trap management can be entered directly into the TM unit and stored.

Data communication with the PC is easy

Simply connect the accompanying special cable and press the DATA TRANS key. No complicated set-up process is required. Afterward, the communication process can be easily performed on the PC while viewing the PC screen.

Possible to listen to the sound of operation using an earphone

The accompanying earphone can be used to listen to the sound of steam trap operation (TM5N standard type only).

Battery can be charged in 2 hours

Approximately 2 hours of charging allows continuous operation for 8 hours (when back light is used). The TM includes a function to prevent overcharging and a battery reconditioning function.

3. Measurement Principles

3.1 Principles of Steam Leakage Judgement

3.1.1 TM measures ultrasonic waves

The conventional methods for steam trap diagnosis are surface temperature and sound. In the past, sound audible to the human ear was used, but now that is being replaced by the ability of the TM to detect ultrasonic waves humans cannot hear.

The advantage of using ultrasonic waves is that they are generated at the initial stages of steam leakage, and are unaffected by surrounding noise. As a result, steam trap deterioration can be detected at an early stage.

3.1.2 There is a correlation between ultrasonic waves and steam leakage

When steam traps leak steam, they emit ultrasonic waves. There is a correlation between the intensity of the ultrasonic waves generated and the amount of steam leakage; however, this correlation varies depending on the model of steam trap. The correlation formula will also differ depending on the location at which measurements are made.

3.1.3 TM stores correlation with steam leakage according to trap model

Each correlation between the intensity of the ultrasonic waves and steam leakage is stored in the TM according to the steam trap type. The TM can then use these correlations to calculate the amount of steam leakage based on the intensity of the ultrasonic waves. The inlet connection point is also fixed as the measurement point on each trap, allowing for better correlation reliability, and automatic judgement of trap operation status.

3.1.4 Steam Loss Test Apparatus

Data on the correlation between the intensity of ultrasonic waves generated and the amount of steam leakage has been collected by TLV using the Steam Loss Test Apparatus at TLV CO., LTD. headquarters. So far, data for over 100,000 cases has been collected in this ongoing process.

3.2 Principles of Condensate Backup Judgement

3.2.1 Measuring inlet temperature of the steam trap

If the steam trap is operating properly, the inlet temperature of the trap will be almost exactly the same as the saturation temperature of the steam pressure in that location. If blocked or undersized, condensate will collect at the trap inlet and the trap inlet temperature will drop.

Accordingly, measuring the inlet temperature of the trap allows one to determine the backup of condensate or the blockage status.

3.2.2 Comparing the calculated saturation temperature with the surface temperature

The correlation between saturation temperature and various steam pressures is stored inside the TM hardware, enabling the saturation temperature to be calculated when a pressure value is entered. By comparing the calculated saturation temperature with the surface temperature measured at the trap inlet, the TM hardware is able to judge the amount of condensate that has collected.

a) BLOCKED Judgement:

Measured surface temperature ≤ 40 °C (104 °F).

Made when the surface temperature at the trap inlet is less than or equal to 40 °C (104 °F). (≤ 30 °C (86 °F) for temperature control traps.)

b) LOW TEMP. Judgement:

Measured surface temperature < saturation temperature × 0.6.

Made when the surface temperature at the trap inlet is less than 60% of the saturation temperature (for other than temperature-adjustable traps).

The reference value of 60% may be changed.

The criterion for judgement of LOW TEMP. "saturation temperature × (up to but not including) 60%" was set because there have been cases in past tests (that considered the material and body thickness of each model of trap and external environmental conditions) in which the trap surface temperature even at normal times generally dropped by about 40% of the saturation temperature.

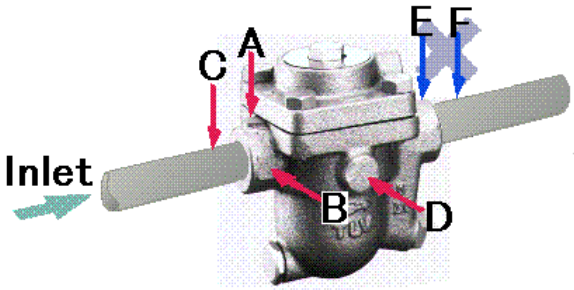
3.3 Measurement Position

3.3.1 Standard horizontal pipes

Traps should be measured at the trap inlet, which may be at the bottom of the trap in some instances. Hold the probe perpendicular to the flat surface at the inlet and press firmly for 15 seconds.

The point at which the measurement is taken must be filed smooth and flat with the file delivered with the unit. Refer to "6.3 Using the Probe".

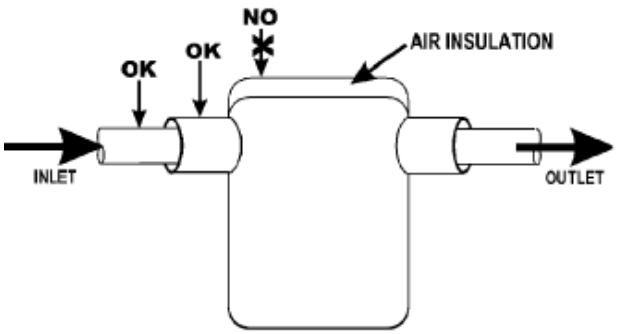
The standard measurement position is point A in the figure below.



If the trap cannot be measured at point A, point B, C or D may be substituted. However, please note that the accuracy of judgements will be adversely affected if measurements are made at points other than the standard point A.
Also note that judgements cannot be made at points E and F at the trap outlet.

Before measurement begins, close the Lock Release Valve (LRV) on the trap if equipped. Set the LRV to its previous position once measurement is completed.

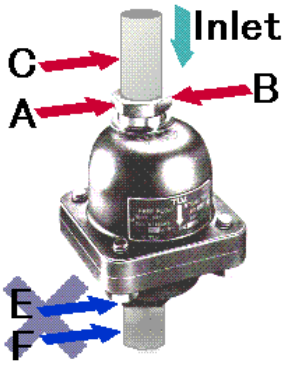
For bucket traps with air insulation, the inspection surface should be prepared on the steam piping ahead of the trap inlet or on the trap inlet. Do not measure from the top of the trap.



OK: Standard measurement point
NO: Will result in incorrect measurement

3.3.2 Standard vertical pipes

Traps should be measured at the trap inlet, which may be at the bottom of the trap in some instances. Hold the probe perpendicular to the flat surface at the inlet and press firmly for 15 seconds.



The point at which the measurement is taken must be filed smooth with the file delivered with the unit. Refer to "6.3 Using the Probe".

The standard measurement position is point A or point B [in the figure below].If the trap cannot be measured at point A or point B, point C may be substituted. However, please note that the accuracy of judgements will be adversely affected if measurements are made at points other than the standard point A or point B.

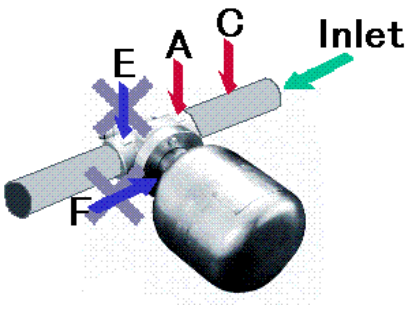
Also note that judgements cannot be made at points E and F at the trap outlet.

3.3.3 Universal type

Traps should be measured at the trap inlet, which may be at the bottom of the trap in some instances. Hold the probe perpendicular to the flat surface at the inlet and press firmly for 15 seconds.

The point at which the measurement is taken must be filed smooth with the file delivered with the unit. Refer to "6.3 Using the Probe".

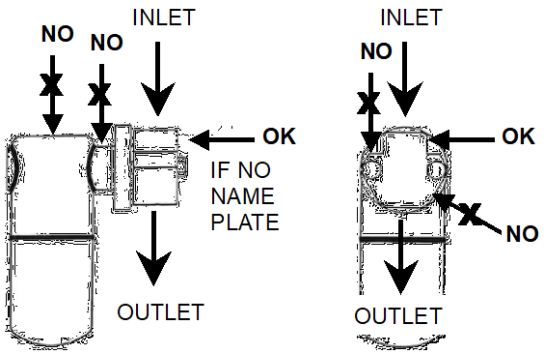
The standard measurement position is point A [in the figure below].



If the trap cannot be measured at point A, point C may be substituted. However, please note that the accuracy of judgements will be adversely affected if measurements are made at points other than the standard point A.

Also note that judgements cannot be made at points E and F at the trap outlet.

For bucket traps with a universal connector, the inspection surface should be prepared on the top of the face of the connector if there is no nameplate, or on the flat on the top of the connector.



OK: Standard measurement point

NO: Will result in incorrect measurement

3.3.4 Other installation

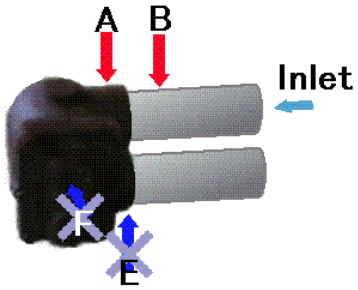
Traps should be measured at the trap inlet, which may be at the bottom of the trap in some instances. Hold the probe perpendicular to the flat surface at the inlet and press firmly for 15 seconds.

The point at which the measurement is taken must be filed smooth with the file delivered with the unit. Refer to "6.3 Using the Probe".

The standard measurement position is point A in the figure below.

If the trap cannot be measured at point A, point B may be substituted. However, please note that the accuracy of judgements will be adversely affected if measurements are made at points other than the standard point A.

Also note that judgements cannot be made at points E and F at the trap outlet.

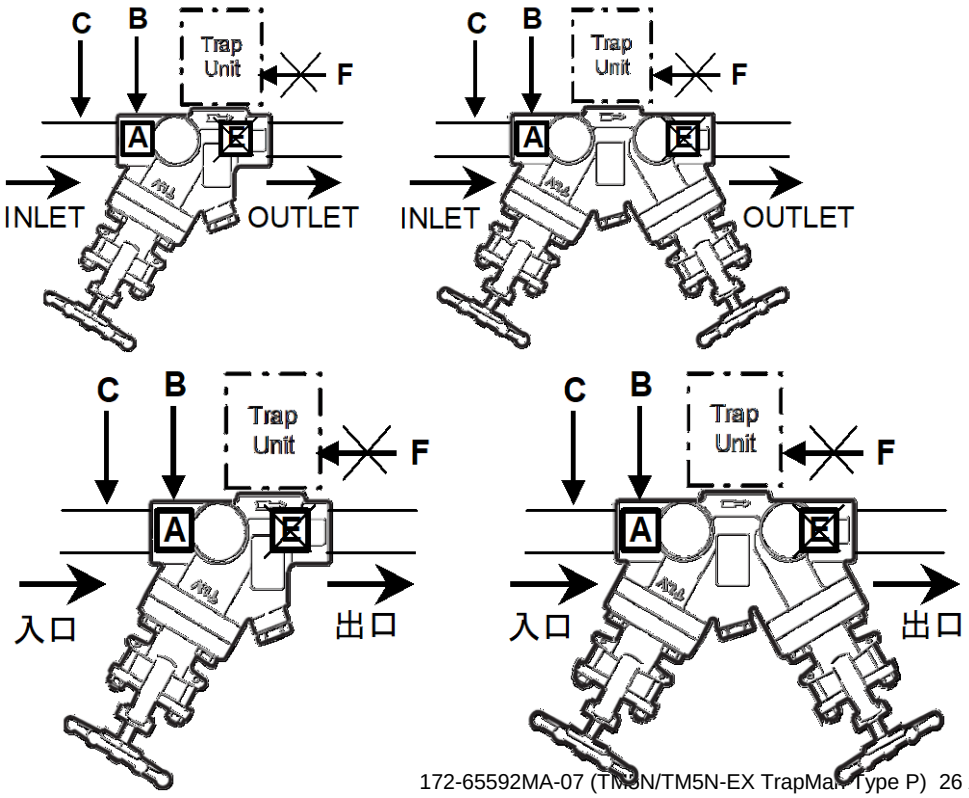


3.3.5 Trap station

Traps should be measured at the trap station inlet.
The point at which the measurement is taken must be filed smooth with the file delivered with the unit. Hold the probe vertically to the flat surface at the inlet and press firmly for 15 seconds. Refer to "6.3 Using the Probe".

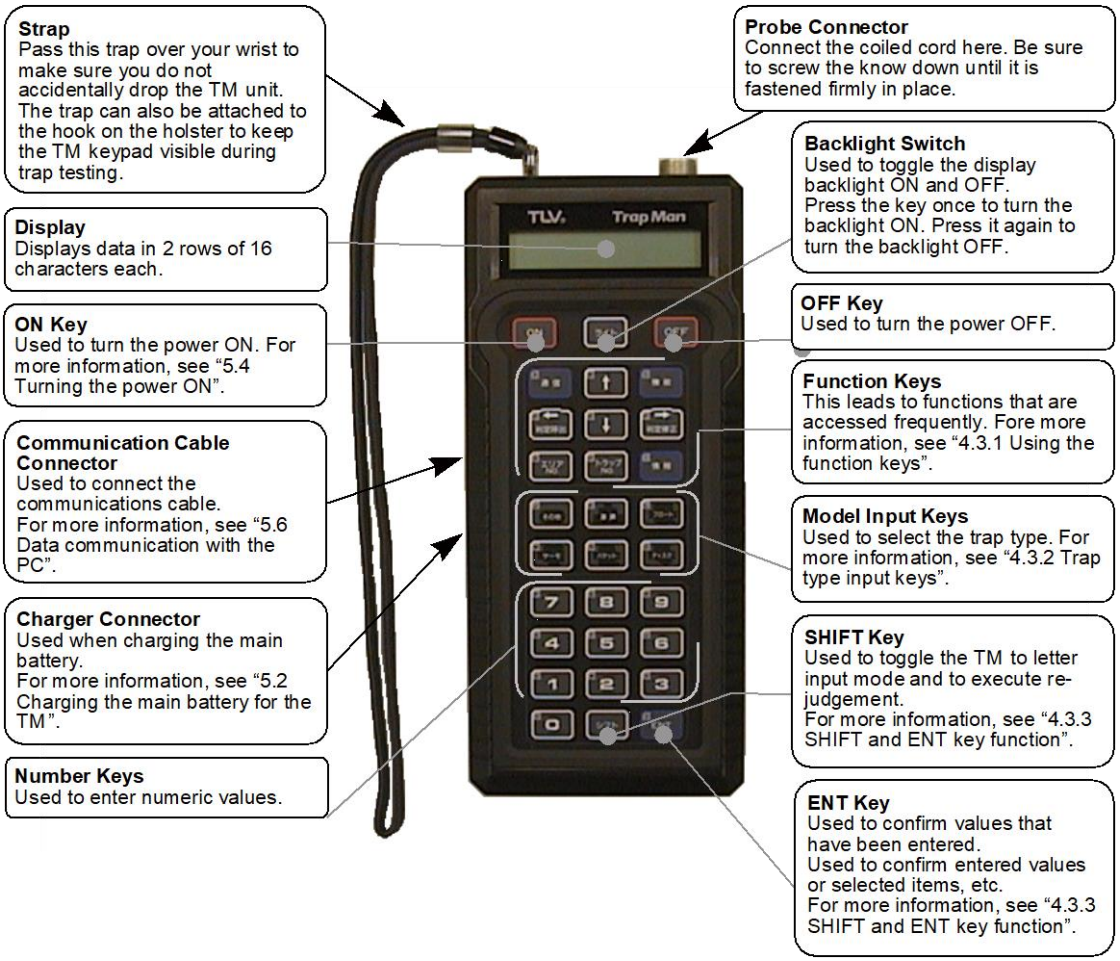
The standard measurement position is point A. (Figure below shows the point where the probe should be pressed to.)

If the trap cannot be measured at point A, point B and C may be substituted. However, please note that the accuracy of judgements will be adversely affected if measurements are made at points other than the standard point A.
Also note that judgements cannot be made at points E and F.

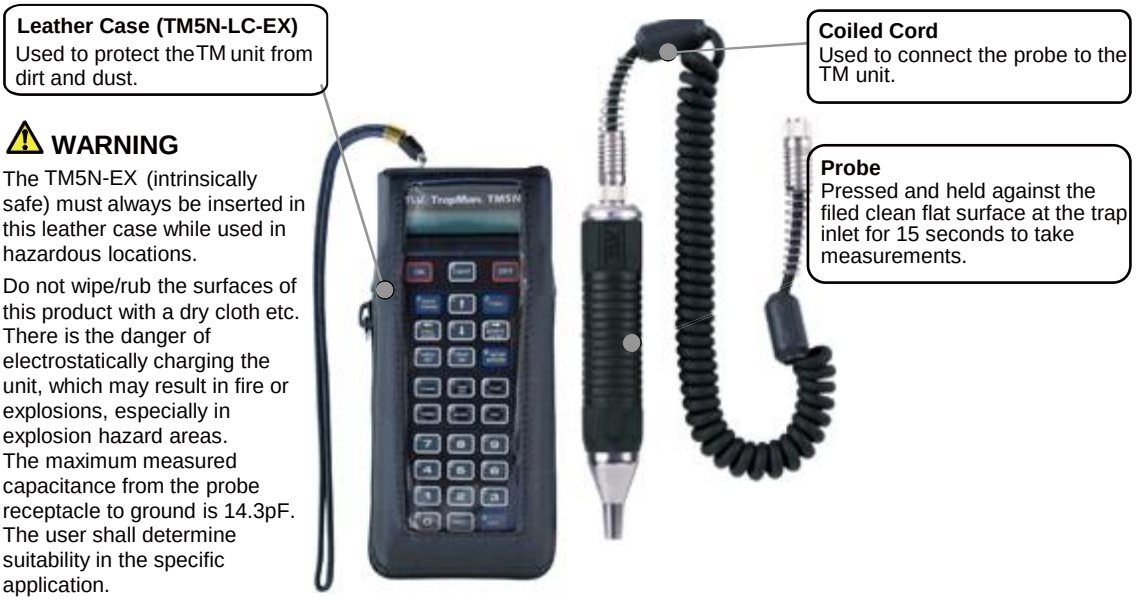


4. Part Names

4.1 TM Unit



4.2 Probe and Leather Case



⚠ WARNING

The TM5N-EX (intrinsically safe) must always be inserted in this leather case while used in hazardous locations.

Do not wipe/rub the surfaces of this product with a dry cloth etc. There is the danger of electrostatically charging the unit, which may result in fire or explosions, especially in explosion hazard areas.
The maximum measured capacitance from the probe receptacle to ground is 14.3pF. The user shall determine suitability in the specific application.

4.3 Function Keys

4.3.1 Function keys

DATA TRANS	Used for data transfer with the PC.
FUNC	Used to tabulate inspection data and change settings.
INFO	Used for entering detailed data on pipes and the operating conditions for measured traps, etc.
↑ ↓	Used to scroll through the screens for recalling inspection data selecting INFO key items, registering/recalling trap model names.
CALL JUDGE	Used to toggle the display between the stored judgement and the model name, and to move the cursor to the left.
MODIFY JUDGE	Used to modify a stored judgement, and to move the cursor to the right.
AREA NO. TRAP NO.	Used to enter and recall the control numbers for area and trap number

4.3.2 Trap type input keys

OTHERS TEMP. ADJ FLOAT THERMO BUCKET DISC	These keys are used to enter and register trap models. Up to 30 model names can be entered for each trap type.

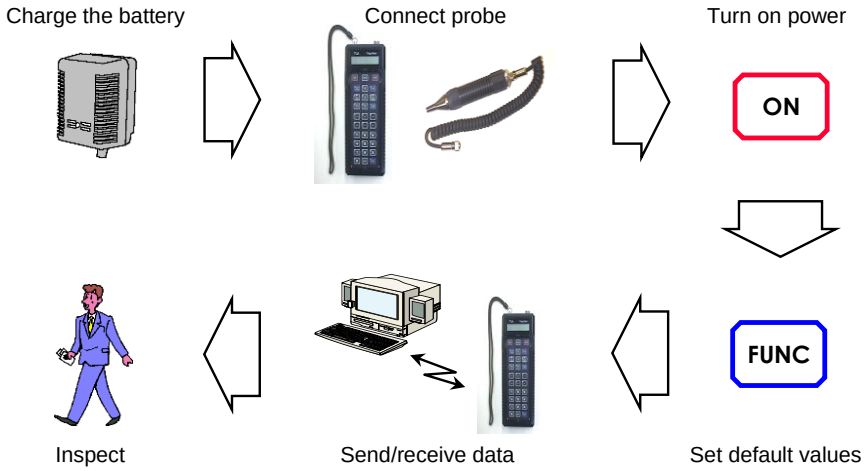
4.3.3 SHIFT and ENT key functions

SHIFT	Used to toggle the mode for control number input to capital letters, and to execute re-judgement.
ENT	Used to confirm entered values or selected items, etc.

5. Preparing for Inspection

5.1 Preparing for Inspection

Before starting the inspection, you should prepare the TM hardware with the procedures indicated by the graphics below.



5.2 Charging the Main Battery for the TM

Before starting the charging process, be sure to read "1.3.1 Charging Precautions".

1. With the TM OFF, unlock and remove the connector cover on the side of the TM body. TM5N-EX (intrinsically safe): Be sure to retain the cover screw in a safe place. The connector cover must be replaced and the screw secured in order to maintain intrinsically safe certification.

2. Insert the plug for the special battery charger included with the unit into the DC-IN side.

3. Plug the AC adapter for the battery charger unit into the outlet.

   To discharge battery: (charger will automatically switch to charging mode once discharge is complete)
   1) Press the Discharge button on the charger.
   2) The "Discharge" LED (green) will light up.
   3) Once discharge is complete, the "Discharge" LED (green) will start to blink, and the charger will begin charging automatically.

      Discharge time varies depends on the remaining capacity of the battery. It takes approximately 6.5 hours for a fully charged battery.

      When you wish to stop discharging the battery early, or to switch to charging mode, temporarily unplug the charger to reset it. Discharge cannot be halted using buttons.

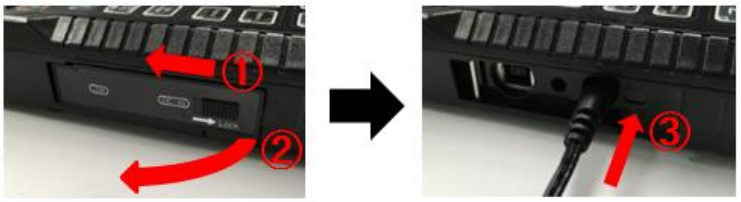
      Full discharge of the battery is linked to prevention and/or resolution of memory problems. It is recommended to fully discharge the battery before charging. The charger will automatically switch to charging mode once discharge is complete.

To charge

1) Press the Charge button on the charger.
2) After 1 minute the "Start" LED (green) will start to blink and main charging will begin.
3) Once charging is complete, the "Finish" LED (green) will start to blink.
4) Unplug the charger from the outlet, remove the charger plug from the TM.

If all of the LEDs are blinking there may be a problem with the batteries. Check that the batteries are correctly installed or replace with new ones.

4. Unplug the charger from the outlet, remove the charger plug from the TM, replace the connector cover and lock it. TM5N-EX (intrinsically safe): Be sure to replace and secure the cover screw in order to maintain intrinsic safety.

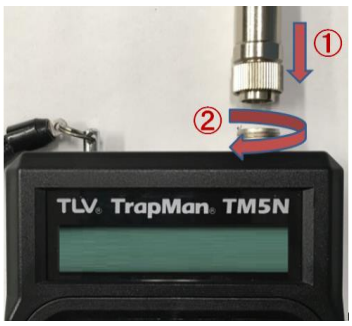


CAUTION

- Be sure to use only the special battery charger included with the unit.
- The system is designed so the TM power cannot be turned **ON** while the battery is charging/discharging. This is not a defect.
- The ambient temperature during the charging/discharging process should be between 10 and 40 °C (18 and 104 °F).

5.3 Connecting the Probe

Use the coiled cord to connect the probe to the TM unit body. The cord may be connected in either direction. Be sure to fasten the coupling on the connector securely.



CAUTION

When connecting and disconnecting the coiled cord, hold it by the metal part of the connector. Pulling on the cable may break the wires inside.

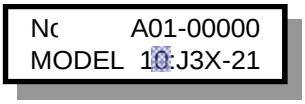
5.4 Turning the TM Power ON

1. Press ON.
   During the first two seconds, the TM version data will be displayed. After that, the following will be displayed:
2. Either a blank screen, or the name of the customer for whom the inspection is being carried out will be displayed.
   If the inspection data has already been downloaded, the customer's name will be displayed, otherwise a blank screen will be displayed.
   Press ENT to continue.
   If the name displayed on screen is not that of the customer for the current inspection, either download the data again or consult the person in charge at TLV.
   If a blank screen is displayed, follow the steps in "5.6 Data Communications with the PC" to download the inspection data.
3. Enter Inspector ID
   Enter the Inspector ID (4 digits) and press ENT to continue.
4. Messages concerning scheduled maintenance will be displayed (when applicable).
   After confirming the message contents press ENT to continue.
   For message details consult "1.1 TM Periodic Required Maintenance" of section "1 Read Carefully Before Use".

5a. If any data remains to be sent to the PC, the following confirmation message will blink on the screen:

The message will disappear when AREA NO., TRAP NO. or ENT is pressed. To store data that has not yet been updated, transfer the data to the PC.

5b. If there is no remaining data to be updated, the following will appear:



The area and trap numbers that appear here are those that were displayed when the power was last turned off.
If the data has been cleared, 000-00000 will be displayed for the area and trap numbers.

5.5 Turning the TM Power OFF

Hold down OFF for at least 1 second.

To prevent the power from being turned off accidentally, the TM power will not go off unless the key is held down for at least one second.

5.6 Data Communications with the PC

1. With the TM switched OFF, unlock the connector cover on the side of the TM and remove the connector cover. TM5N-EX (intrinsically safe): Be sure to retain the cover screw in a safe place. The connector cover must be replaced and the screw secured in order to maintain intrinsic safety.

2. Insert the USB cable included with the unit into the port on the side of the TM. The connector must be inserted in the correct orientation.

3. Press [ON] to turn on the power. (If there is any data remaining to be updated, send this data to the PC if necessary, using the procedure below. When data is received from the PC, the data remaining on the TM will be automatically deleted.)

4. Press [DATA TRANS]. The default DATA TRANS screen will appear.

```
**READY** START
TRANSMISSION
```

5. For the rest of the procedure, follow the directions on the PC screen. No other operation is required on the TM until you exit **DATA TRANS** mode.
   The following messages will appear showing the status of **DATA TRANS**.

```
TRANSMITTING
No OF TRAPS=00000
```
(displayed while data is being sent from the TM)

```
RECEIVING DATA
NO OF TRAPS=00000
```
(displayed while data is being received from the PC)

```
TRANS COMPLETED
TOTAL Q'TY=00000
```
(displayed when the **DATA TRANS** process is complete)

6. When an error message has appeared during the **DATA TRANS** process, see "12.1 Error Messages".

7. To return to the display of area/trap numbers, press [DATA TRANS] again.

8. Press [OFF] to turn off the power before removing the USB cable from the TM and the PC.

6. Inspection Procedure

Before attempting inspection, be noted that there are steam traps that cannot be evaluated. See "1.5 Steam Traps that cannot be Evaluated".

Follow the steps below when measuring trap performance at the site:

1. Turn the TM power ON.

2. Enter the control number
   Enter the control number for the trap to be measured.
   The control number consists of a three-digit area number and a five-digit trap number. Normally the equipment code and pipe line name code are entered for the area number and a sequential number in the area group is assigned for the trap number.

3. Place probe against the trap inlet
   Place the tip of the probe at the trap inlet so it is perpendicular to the plane of the trap.

4. Measure for 15 seconds
   The measurement process will take approximately 15 seconds. When measurement is complete, the TM screen will change automatically.

5. Enter the pressure
   Enter the inlet pressure of the trap that has been measured.

6. Enter the condensate load factor
   Select one of three values for the condensate load factor of the measured trap: minimum ("MIN"), maximum ("MAX") or unknown ("?").

7. Enter the temperature setting
   For temperature adjustable traps only, enter the temperature setting for the measured trap.

8. Judgement is displayed.
   The judgement will be automatically displayed.
   To revise the displayed judgement value, see "7.2 Modifying Judgements". To move to the next trap measurement, return to step 2.

9. Turn the TM power OFF.

6.1 Recalling the Control Number

Two methods are used to recall previously registered or downloaded control numbers.

1. Enter the control number directly and recall that number. (See "6.2 Entering the Control Number" for more information.)
2. Scroll through the registered control numbers.

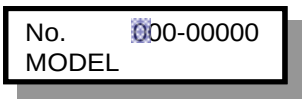
   a. Scroll through the registered control numbers using [↑] and [↓].
   Holding down the key will cause the numbers to scroll automatically; after a few seconds, they will scroll at high speed.

   b. Press [ENT] to confirm that control number.

6.2 Entering the Control Number

The control number consists of a three-digit area number and a five-digit trap number. Normally the equipment code and pipe line name code are entered for the area number and a sequential number in the area group is assigned for the trap number.

Entering the Control Number: Example



1. Use [AREA NO.] and [TRAP NO.] and [0] to [9] to enter the control number.
2. Repeatedly pressing [AREA NO.] or [TRAP NO.] increases the numeric value of the last digit of each (or, in the case of letters, changes the letter in alphabetical order).
3. You may also use [SHIFT] to enter text.
   Press [SHIFT] to switch to text entry mode.
   To enter spaces press [LIGHT] when in text entry mode.
   Press [SHIFT] again to exit text entry mode.
4. Press [CALL JUDGE] or [MODIFY JUDGE] to move the cursor left and right to position the cursor on the digit you wish to change.

Entering the Control Number: Example

To enter "**A01**" for the area number:

NOTE:
The same procedure is used to enter trap numbers, except you should press TRAP NO. instead of AREA NO.

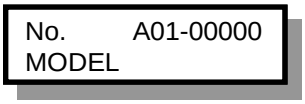
1. Press AREA NO.. The cursor will blink at the first digit of the area number position.

2. Press SHIFT. "S" will appear to indicate that letters may be entered.

3. Press DATA TRANS. "A" will appear at the first digit in the area number and the cursor will move to the second digit position.

4. Press SHIFT. "S" will disappear to indicate that the unit is no longer in letter input mode.

5. Press 0 and 1. "A01" will appear as the area number. The cursor will return to the leftmost position.



6. Press ENT. The cursor will disappear and "A01" will be confirmed as the area number.

6.3 Using the Probe

1. To begin measurement, you must have satisfied the following requirements:

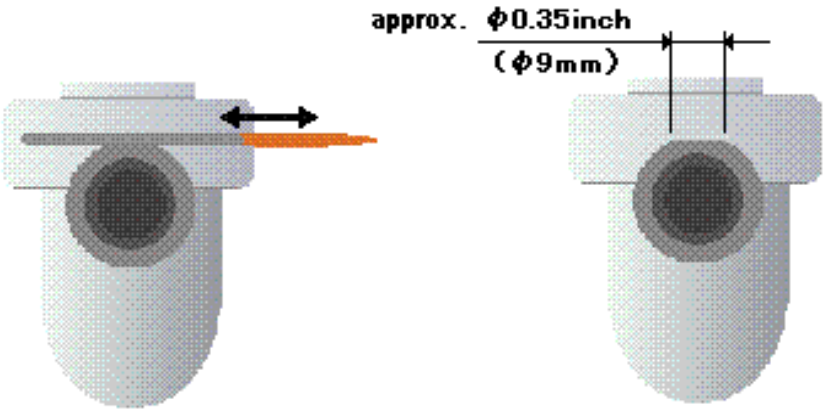
   a. You must set the date and time (see "8.4 Changing Settings").
   The inspection date and time, important information for record keeping and analysis, are automatically recorded when the trap is measured. Confirm that the date and time are properly set and make any corrections necessary before continuing with your survey.

   b. You must set the area and trap number (see "6.2 Entering the Control Number").

   c. The model name must be displayed (see "10.1 Model Memory Function").

   d. The trap to be measured and the model (trap type) name displayed must match.

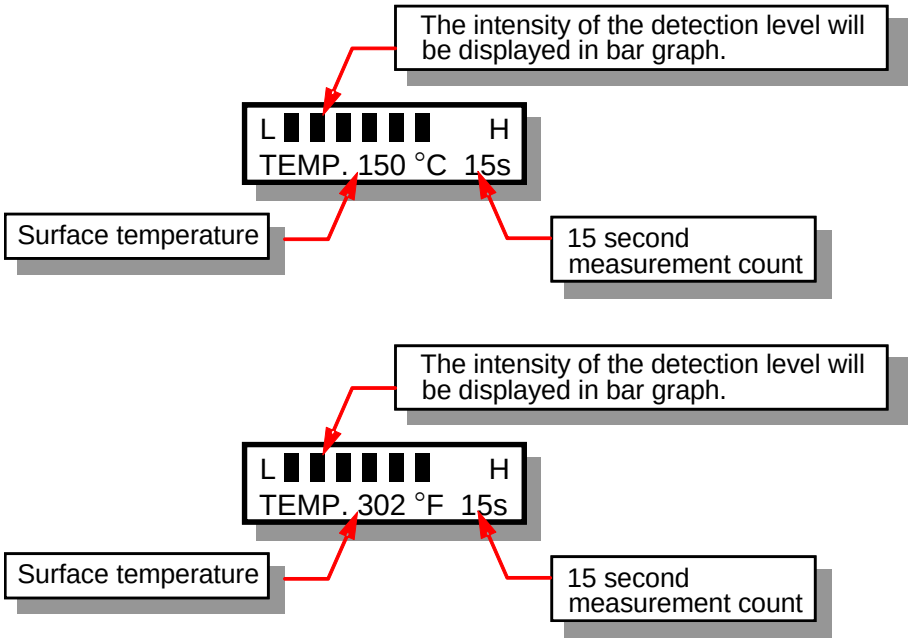
2. Place the probe perpendicular to the standard inlet measurement point on the steam trap body. (See "3.3 Measurement Position".) Use the accompanying file to prepare a clean, smooth, flat surface at the area where the probe tip will contact the trap inlet.



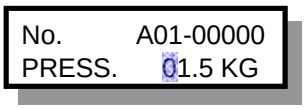
CAUTION

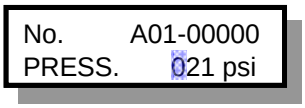
As often as possible, measure at the top of the trap inlet (preferred location). For irregularly shaped or inaccessible traps, see "3.3 Measurement Position". Accurate measurement may not be possible if the measurement cannot be performed at the preferred location. Before measurement begins, close the lock release valve (LRV) on the trap if equipped. Set the LRV to its previous position once measurement is completed.

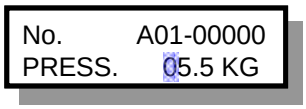
6.4 Messages Displayed During Measurement

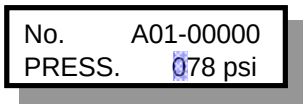


6.5 Entering the Pressure









1. When measurement ends, the screen that allows the user to enter the trap inlet pressure (gauge pressure) will automatically appear. The pressure displayed in this screen is the saturation steam pressure equivalent to the measured surface temperature unless measurements have been done in the past for that control number; then the pressure entered in the past will be displayed.

2. If you know the operating pressure directly ahead of the inlet for the measured trap, enter that value on the numeric keys.
   For example, if the pressure is 5.5 kg/cm^{2}G, enter **0** **5** **5**. The decimal point position is fixed, so it need not be entered.
   For example, if the pressure is 78 psig, enter **0** **7** **8**. There is no allowance for fractional pressures (no decimal).
   Press ENT to establish the value you have entered.

CAUTION

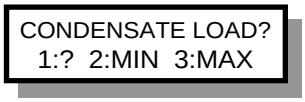
If the exact steam pressure is not known:

- To find out the exact pressure directly in front of the trap, it is best to install a pressure gauge. If this is not possible, determine it as follows:
- The TM is equipped with a function that selects the steam pressure equivalent to the measured surface temperature and displays this value. If the steam pressure is completely unknown, do not enter a steam pressure value. Simply press ENT after the equivalent pressure value is displayed to proceed with automatic determination of the trap judgement. Note that the surface temperature is not the actual internal temperature of the trap, so the accuracy of the judgement will be slightly reduced.

NOTE:
It is possible to revise the value or redo the judgement after the pressure has been entered. For more information, see "7.3 Re-judgement".

6.6 Condensate Load Factor

1. After the pressure is entered, the screen for entering the condensate load factor for the measured trap will automatically appear.



If you have selected the trap before, the cursor will blink over the condensate load factor. If you have newly created an entry for this trap, the cursor will blink over an initial value of "1:?"

Estimate the condensate load on the measured trap as a percentage of the trap's rated capacity (see table below) and enter **2** if the condensate load is small and **3** if the condensate load is large. If the condensate load is somewhere in between, or if you do not know what it is, press **1**.

CAUTION

Condensate load is not requested for temperature adjustable traps, or if the surface temperature is low and the trap status is judged to be BLOCKED (surface temperature below 40 °C (104 °F) or 30 °C (86 °F) for temperature adjustable traps) or LOW TEMP (surface temperature below 60% of the saturation temperature for the pressure entered).

2. The standards for selection of the condensate load status are as follows:

- Think of the condensate load status as:

$$\frac{\text{(Amount of condensate currently being discharged)}}{\text{(Trap capacity under operating conditions)}} \times 100\ (\%)$$

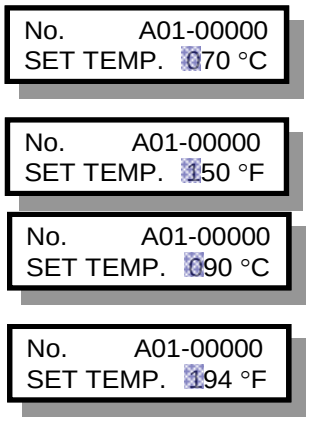
- Use the following standards to select the key to be pressed:

Condensate load status	Less than 10%	More than 90%	10 to 90% or unknown
Key	2:MIN	3:MAX	1:?

NOTE:
It is possible to revise the value or redo the judgement after the condensate load factor has been entered.
For more information, see "7.3 Re-judgement".

6.7 Entering the Temperature Setting

You must enter the temperature setting only in the case of a temperature adjustable trap. After the pressure has been entered, the unit will prompt you to enter the temperature setting for the measured temperature adjustable trap.



If no temperature setting has previously been entered, "70 °C (150 °F)" will be displayed. If a temperature setting has previously been entered for the same control number, that value will appear.

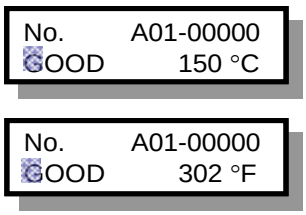
To enter a temperature setting of 90 °C (194 °F), enter 0 9 0 (1 9 4).

If the entered value is satisfactory, press ENT to establish that value. The judgement and surface temperature will be displayed as in the case of other traps.

NOTE:
It is possible to revise the value or redo the judgement after the temperature setting has been entered. For more information, see "7.3 Re-judgement".

6.8 Judgement

After the condensate load factor or the temperature setting has been entered, the judgement and measured surface temperature will be displayed.



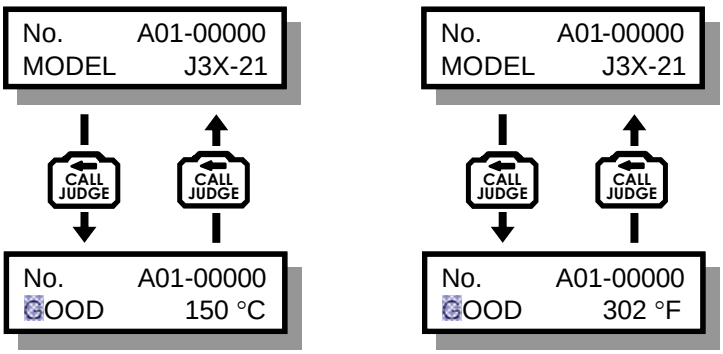
If the cursor is blinking, it indicates that the judgement has not yet been finalized and can be modified if necessary.

If the displayed judgement is satisfactory, press ENT to finalize the judgement.

7. Judgement

7.1 Recalling Judgements

Pressing CALL JUDGE toggles the display between the judgement and the model name.



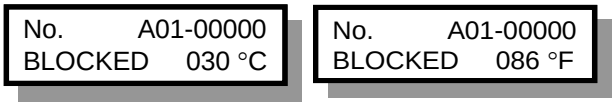
NOTE:
It is possible to revise the judgement even after it has been finalized. For the procedure, see "7.2 Modifying Judgements".

7.2 Modifying Judgements

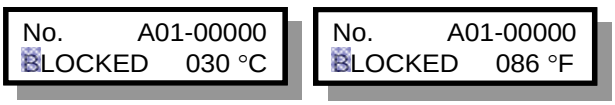
MODIFY JUDGE can be used to revise judgements manually.

For example, to change an automatic judgement of BLOCKED to NOT IN SERVICE, use the following procedure:

1. Press the CALL JUDGE to display the judgement. This step is not necessary if the judgement is already displayed.

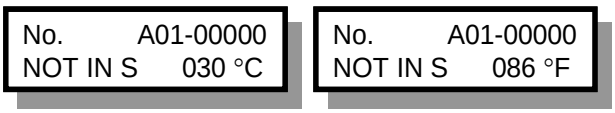


2. Press MODIFY JUDGE once. The cursor will blink at the judgement position.



3. Press CALL JUDGE several times in succession to scroll through the judgement items on the display.

4. When the NOT IN SERVICE judgement item appears, press ENT. The cursor will stop blinking and the judgement of NOT IN SERVICE will be established.



7.3 Re-judgement

Once measurement has ended, automatic judgement can be performed again without pressing the probe against the trap.

1. Recall the trap number for re-judgement by pressing AREA NO., TRAP NO. or by scrolling through the trap numbers using ↑ or ↓.
2. Press CALL JUDGE to display the judgement.
3. Press SHIFT. The status will return to the status just after the 15-second measurement process ended and the screen for entering the pressure will appear. If you wish to change the previously entered pressure value, do so at this time and press ENT to establish the change. If you do not wish to change the previously entered pressure value, simply press ENT.
4. After the pressure has been entered, the screen will change to the one used to enter the condensate load factor. Re-enter the condensate load factor (the condensate load factor should be re-entered even if it hasn't changed) and press ENT.
5. When changes have been made and a new judgement has been made, press ENT to finalize the change.

CAUTION

Re-judgement is not possible unless measurement has been completed for that trap.

7.4 Automatic Judgement Items

GOOD:
The measured trap has been judged to be functioning normally.

LEAKING (S/M/L):
The measured trap has been judged to be leaking steam. One of fifteen (15) levels will be displayed.

BLOWING:
The measured trap has been judged to be leaking steam above the level of an "L" leakage.

LOW TEMP:
The surface temperature at the inlet of the measured trap is less than 60% of the saturation temperature for the entered pressure.

BLOCKED:
The surface temperature of the measured trap is less than 40 °C (104 °F) (or 30 °C (86 °F)) in the case of a temperature control trap).

FAILED ADJ (Failed Adjustment):
This error is displayed only for temperature adjustable traps. It appears when the surface temperature of the trap is outside the range of (temperature setting -15 °C (27°F)) × 0.7 – (temperature setting + 15 °C (27°F)) × 1.5 of the temperature setting that has been entered.

7.5 Manual Judgement Items

These items can be entered when modifying judgements.

NOT IN S (Not in Service):
The measured trap is not operating.

VALVED OUT:
The inlet or outlet valve to the steam trap is closed (no steam supplied).

CFM REQ. (Confirmation Required):
Further confirmation is required to determine the trap operating condition.

COLD: CFM REQ. (Cold: Confirmation Required):
Steam trap temperature is low, further confirmation is required to determine the trap operating condition.

L/GASKET:
Steam is leaking from a gasket or gaskets on the measured steam trap.

L/BODY:
There is a hole or crack in the body of the trap and steam is leaking.

L/JOINT:
Steam is leaking from the steam trap connection.

INACCESSIBLE:
Steam trap can not be reached for inspection. Some causes might be steam traps installed in high locations, in pits, under gratings, etc.

INSTALL FAULT:
The steam trap has not been installed correctly, and as a result judgment about the operating condition cannot be determined until the steam trap is installed correctly.

TRAP REQUIRED:
A steam trap is not installed, but it is required for the location.

REMOVED:
Previously existing steam trap has been removed and is no longer required.

NO CHECK:
The trap has been registered but has not yet been inspected.

8. Using the Function Keys

8.1 Using the Function Keys

Pressing FUNC changes the mode to function mode and allows the following functions to be executed.
To exit function mode, press FUNC again.

1 : 8.2 Tabulate Inspection Results

2 : 8.3 Search for Failed Traps

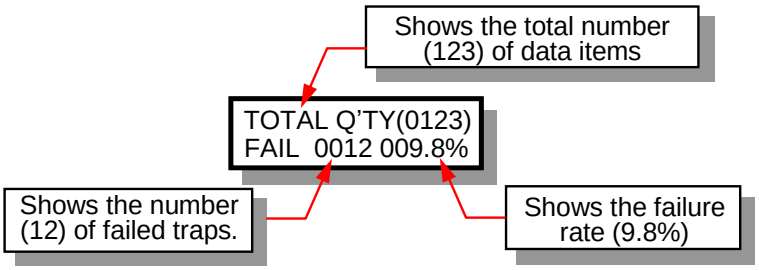
5 : 8.4 Change Settings

8 + 8 : 8.5 Automatic Initialization of Settings

9 + 9 : 8.6 Clear (delete) Inspection Data

8.2 Tabulating Inspection Results

1 displays the total number of trap data items including uninspected traps, the number of failed traps and the failure rate.

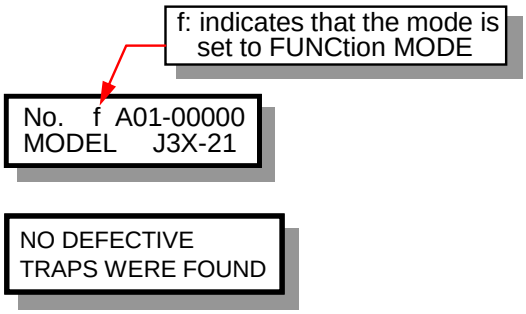


NOTE:
TOTAL Q'TY refers to all trap data currently stored in the TM.
The denominator for calculating the failure rate (total number of data items) is the total quantity of traps stored in the TM excluding uninspected and not in service traps.

8.3 Searching for Failed Traps

a. [2] displays only the failed traps from among those inspected.

You can use [▲] and [▼] to scroll through only the faulty traps.



b. If there are no faulty traps:

NOTE:
While using this function to view failed traps, the judgement results and trap information are also accessible.

8.4 Changing Settings

Default values are set before the unit is shipped from the TLV factory.

These settings should be changed only when necessary.

1. Use [FUNC] [5] to check the following settings.
2. Press [▲] and [▼] to scroll through the settings.
3. When the item you wish to change appears, press [ENT]. The cursor will blink at the position of that setting. The setting may now be changed.
4. Change the setting and then press [ENT] again. The status will return to step 2 above.
5. To exit setting change mode, press [FUNC] again.

8.4.1 No. of measurements

The cumulative number of measurements made to-date.
This value is used as data for the calibration interval. It cannot be changed.

8.4.2 LCD brightness adjustment

Press [▲] and [▼] to adjust the brightness of the LCD screen.

8.4.3 LCD contrast adjustment

Press [▲] and [▼] to adjust the contrast of the LCD screen.

8.4.4 Earphone volume adjustment

Press [▲] and [▼] to adjust the volume for the earphone.

8.4.5 Date and time

The date and time are preset to Japan time at shipping, but will be reset to the local time when the unit is connected to TrapManService.net.

The date and time cannot be changed manually.

8.4.6 Reference value for LOW TEMP judgement

This is the standard used for determining when the temperature is abnormally low. The default value is 60%. The temperature is judged to be abnormally low when the surface temperature is below this value with respect to the saturation temperature of the pressure entered following measurement.

Use [0] to [9] to enter this value.

8.4.7 Auto power OFF setting

The **Auto power OFF** function turns the power off automatically if the TM unit is not operated for five minutes. This setting enables or disables this function. The default setting is enabled (AUTO POWER OFF).

Use [▲] or [▼] to select the desired setting.

CAUTION

Auto Power OFF does not function in **DATA TRANS**, **FUNCtion** or **INFOrmation** modes, or during the control number entry process.

8.5 Automatic Initialization of Settings

Pressing [8] + [8] resets the values to their factory default settings.

1. A confirmation message will appear.
   Press [ENT] to execute the operation.
   Press [FUNC] to cancel the operation.

2. The following items will be automatically executed:

   - Inspection data will be cleared (deleted).
   - The LOW TEMP factor will be reset to 60% (the default value).
   - The **Auto power OFF** function will be enabled.

CAUTION

Once you have started the initialization process, it cannot be canceled. For information on setting these items individually, see "8.4 Changing Settings" and "8.6 Clearing (Deleting) Inspection Data".

8.6 Clearing (Deleting) Inspection Data

Pressing [9] + [9] clears (deletes) all inspection data.

A confirmation message will appear:
Press [ENT] to execute the operation.
Press [FUNC] to cancel the operation.

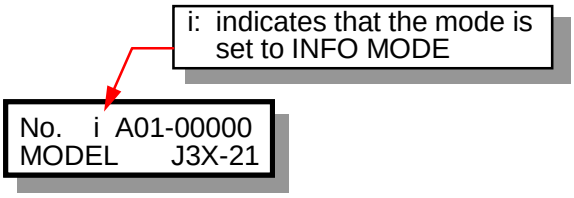
CAUTION

It is not possible to clear only a portion of the data.

9. Information Mode

9.1 Displaying INFOrmation Mode

Press INFO to change to information mode.
In this mode, you can check and enter data for the control numbers for which a model name has been entered.
Press ↑ or ↓ to scroll through the items.
To exit Information mode, press INFO again.



CAUTION

Information mode will not function for control numbers for which no model name has been entered.

9.2 INFOrmation Items

The following items can be displayed or edited in information mode.

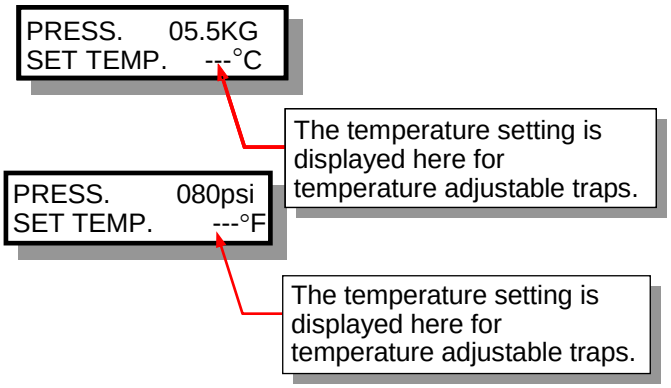
1. Display inlet pressure and temperature settings (temp. control traps only)
2. Display date inspected, judgement and surface temperature
3. Display trap location information
4. Display/edit application
5. Display/edit tracing condition
6. Display/edit priority
7. Display/edit line pressure
8. Display/edit back pressure
9. Display/edit condensate recovery status
10. Display/edit operating time of inspected trap
11. Display/edit operational frequency
12. Display/edit operation type
13. Display/edit install date
14. Display/edit placement/elevation
15. Display/edit trap orientation
16. Display/edit connection size
17. Display/edit connection specification
18. Display/edit bypass valve information
19. Display/edit inlet valve information
20. Display/edit isolation valve (X-valve) Information
21. Display/edit outlet valve information
22. Display/edit inlet pipe size
23. Display/edit inlet pipe specification
24. Display/edit flanged connection face to face length
25. Display/edit screwed connection face to face length

26. Display/edit upstream temperature
27. Display/edit condensate recovery temperature
28. Display/edit disturbance noise information

9.2.1 Display inlet pressure and temperature settings (temp. control traps only)

This item is used to display the trap inlet pressure and the temperature setting for temperature adjustable traps.

Press ↓ ↑ to move to the next or previous item.



CAUTION

These items cannot be entered or revised in this screen.
To revise the values, see "7.3 Re-judgement".

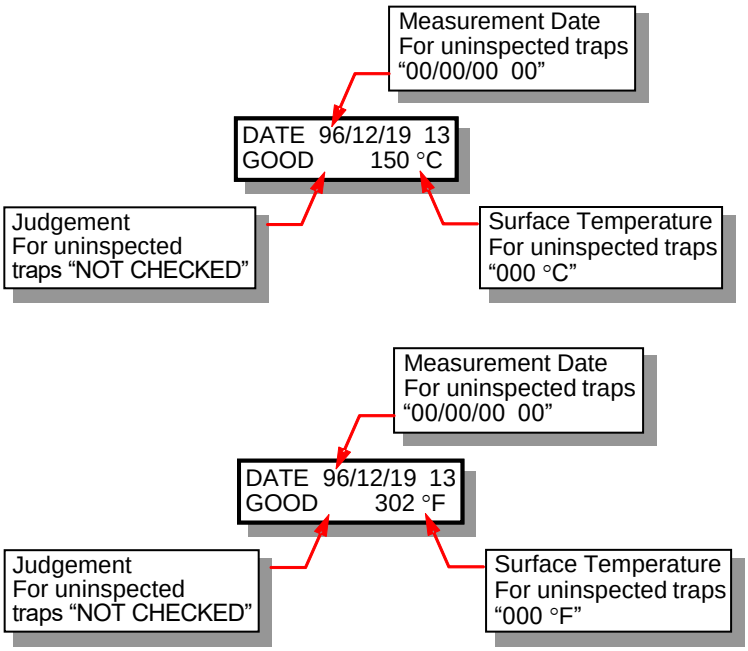
9.2.2 Display date inspected, judgement, and surface temperature

This item is used to display the inspection date, judgement and surface temperature.

Press ↓ ↑ to move to the next or previous item.

CAUTION

These items cannot be entered or revised in this screen.
To revise the values, see "7.2 Modifying Judgements".



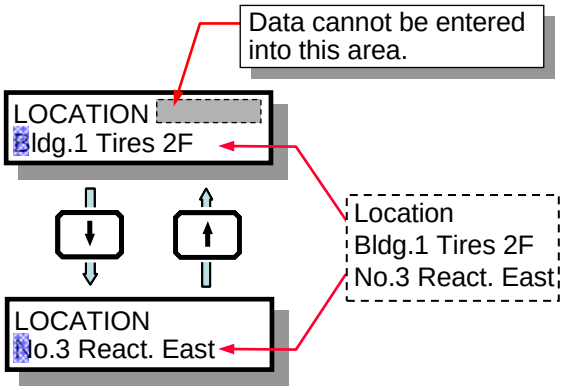
9.2.3 Display trap location information

This item is used to display or edit the location in which the steam trap is installed.

Up to 32 characters can be entered.

Use alphanumeric characters for input. Refer to section "9.3 Entering Text" for input method details.

Press ↑ ↓ to confirm the data and move the cursor to the next or previous item.

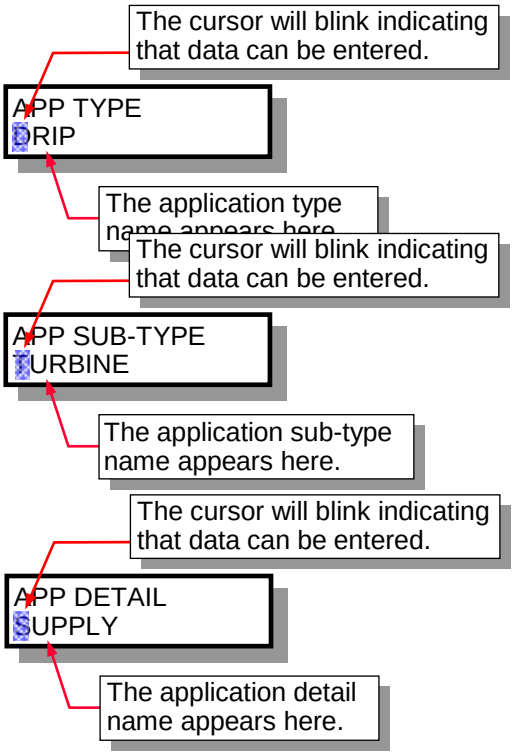


(Ex: Information entered on PC and displayed on the TM screen)

9.2.4 Display/edit application

This item is used to display or edit the purpose for which the trap has been installed.

1. Applications are organized into three levels (Application Type, Application Sub Type, and Application Detail). Application Type is displayed first.
   Use CALL JUDGE MODIFY JUDGE to select an item from the Application Type list.
2. Press ↓ to display the Application Sub Type list, and CALL JUDGE MODIFY JUDGE to select an item from the Application Sub Type list.
   Press ↑ to return to the Application Type list.
3. Press ↓ to display the Application Detail, and CALL JUDGE MODIFY JUDGE to select an item from the Application Detail.
   Press ↑ to return to the Application Detail.

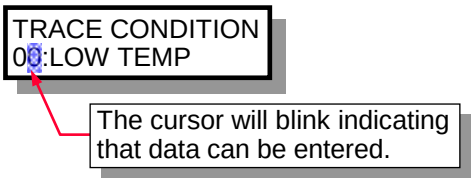


4. Press ↓ to confirm your choice of application and continue to the next item.

NOTE:
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.5 Display/edit tracing condition

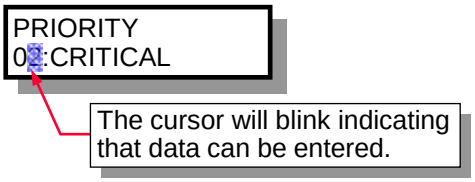
This item is used to select whether or not “Important Tracing”, that is tracing with saturated steam, is necessary, depending on the control temperature of the heated material.
If you do not wish to enter or revise the code, press ↓ to move to the next item.



1. Press CALL JUDGE MODIFY JUDGE to select Important Tracing information.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

9.2.6 Display/Edit Priority

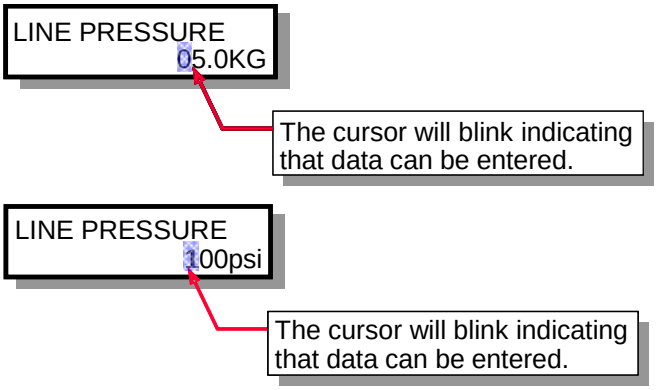
This item is used to classify measured traps according to priority.
If you do not wish to enter or revise the code, press ↓ to move to the next item.



1. Press CALL JUDGE MODIFY JUDGE to select priority.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 99: Unspecified. When you enter new inspection data on the TM, the code for this item will be 99.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.7 Display/edit line pressure

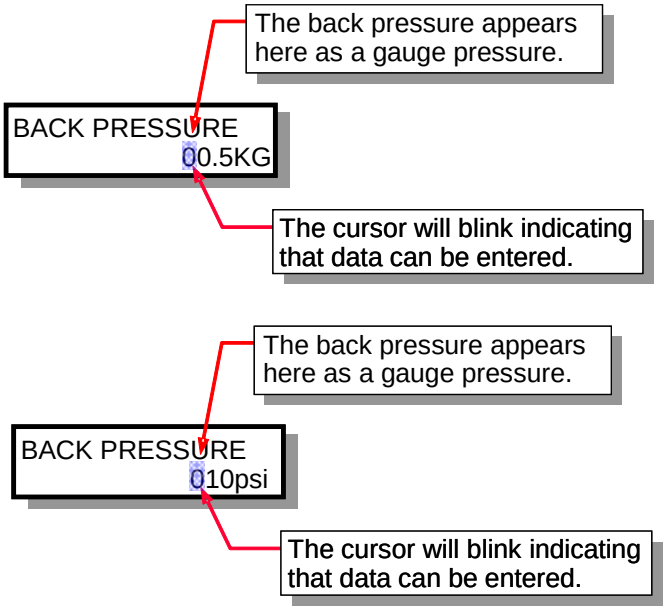


This item is used to enter the line pressure for the steam trap to be inspected.
If you do not wish to enter or revise the value, press ↓ to move to the next item.

1. To enter a line pressure of 5 Kg/cm^{2}G, enter 0 5 0. The decimal point does not need to be entered.
   (To enter a line pressure of 100 psig, enter 1 0 0. The decimal point does not need to be entered.)
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is 0.0 Kg/cm^{2}G (000 psig). When you enter new inspection data on the TM, the value for this item will be 0.0 (000).
Changing this item to a different value makes the new value the default. Once you change the value for a trap by the procedure above, any new traps you add will default to the new value for this item.

9.2.8 Display/edit back pressure



This item is used to display or edit the trap back pressure.

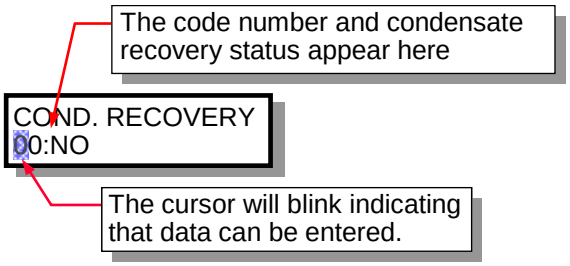
If you do not wish to enter or revise the value, press ↓ to move to the next item.

1. To enter a back pressure of 0.5 Kg/cm^{2}G, enter 0 0 5.
   The decimal point is fixed and doesn't need to be entered.
   To enter a back pressure of 10 psig, enter 0 1 0.
   The decimal point is fixed and doesn't need to be entered.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is 0.0 Kg/cm^{2}G (000 psig). When you enter new inspection data on the TM, the value for this item will be 0.0 (000).
Changing this item to a different value makes the new value the default. Once you change the value for a trap by the procedure above, any new traps you add will default to the new value for this item.

9.2.9 Display/edit condensate recovery status

This item is used to select whether or not condensate from the inspected trap is recovered.
If you do not wish to enter or revise the code, press ↓ to move to the next item.

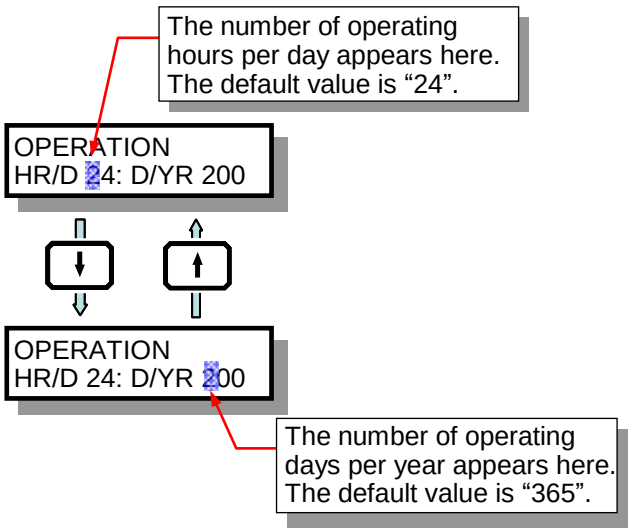


1. Press CALL JUDGE or MODIFY JUDGE to select condensate recovery status (Yes/No).
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 01: YES. When you enter new inspection data on the TM, the code for this item will be 01.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.10 Display/edit operating time of inspected trap

This item is used to check or enter the number of hours each day and number of days each year that the trap is operated.
If you do not wish to enter or revise the value, press ↓ to move to the next item.

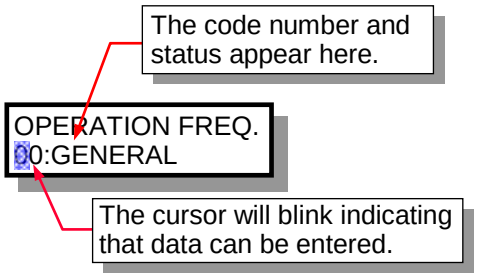


1. Use the numeric keys to enter the value. Be sure to enter a value for all digits. For example, for a trap that operates 200 days a year, enter 2 0 0.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
Changing this value makes the new value the default. Once you change the value for a trap by the procedure above, any new traps you add will default to the new value for this item.

9.2.11 Display/edit operational frequency

This item is used to display or edit the steam trap's operational frequency.
If you do not wish to enter or revise the code, press ↓ to move to the next item.

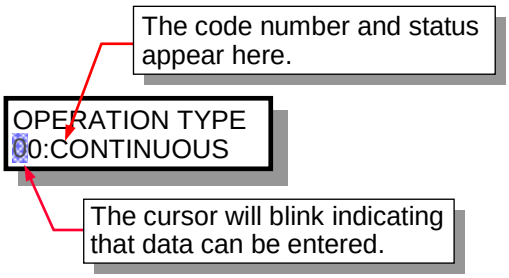


1. Press CALL JUDGE MODIFY JUDGE to select the operational frequency.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 99: Unspecified. When you enter new inspection data on the TM, the code for this item will be 99.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.12 Display/edit operation type

This item is used to display or edit the mode of operation (control method) of the equipment on which trap is installed.
If you do not wish to enter or revise the code, press ↓ to move to the next item.

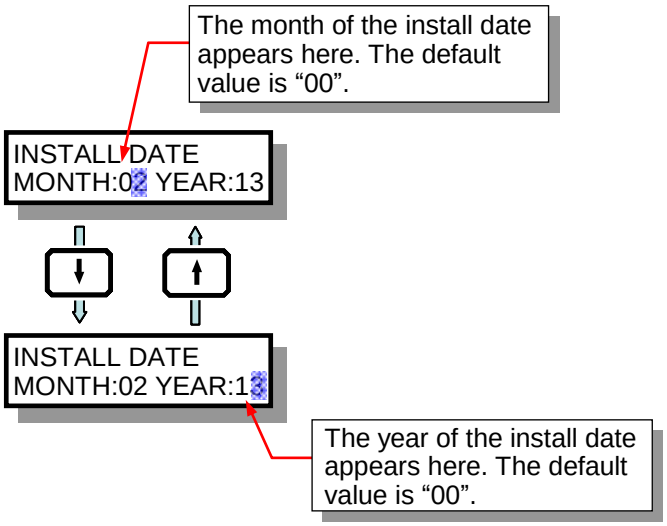


1. Press CALL JUDGE MODIFY JUDGE to select the operation type.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 99: Unspecified. When you enter new inspection data on the TM, the code for this item will be 99.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.13 Display/edit install date

This item is used to display or edit the date that the steam trap was installed.
If you do not wish to enter or revise the value, press ↓ to move to the next item.



1. Use the numeric keys to enter the value. Be sure to enter a 2-digit number.
   For example, to enter "2", enter 0 2.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

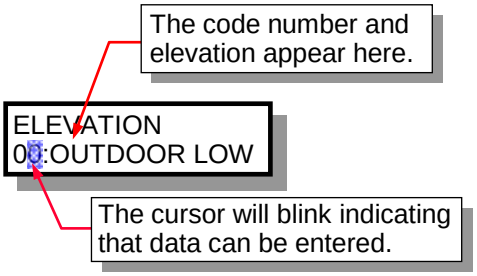
CAUTION

The install date is the most important item of data for analyzing steam trap life. Be sure to enter this value.

NOTE:
The default for this item is 00. When you enter new inspection data on the TM, the value for this item will be 00.
Changing this value makes the new value the default. Once you change the value for a trap by the procedure above, any new traps you add will default to the new value for this item.

9.2.14 Display/edit placement/elevation

This item is used to select the placement/elevation at which the steam trap is installed.
If you do not wish to enter or revise the code, press ↓ to move to the next item.

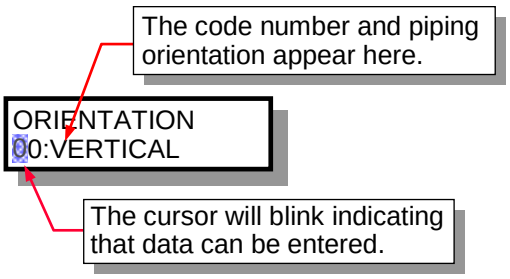


1. Press CALL JUDGE MODIFY JUDGE to select the mounting site.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 99: Unspecified. When you enter new inspection data on the TM, the code for this item will be 99.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.15 Display/edit trap orientation

This item is used to select the steam trap piping orientation.
If you do not wish to enter or revise the code, press ↓ to move to the next item.



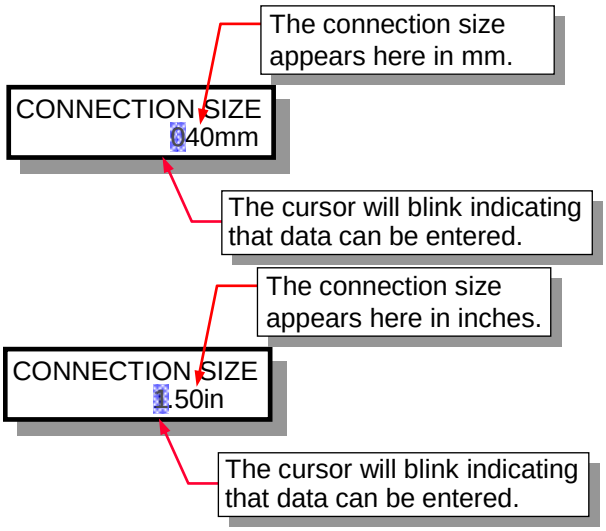
1. Press CALL JUDGE MODIFY JUDGE to select the trap orientation.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 01: HORIZONTAL. When you enter new inspection data on the TM, the code for this item will be 01.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.16 Display/edit connection size

This item is used to display or edit the steam trap connection size.
If you do not wish to enter or revise the value, press ↓ to move to the next item.

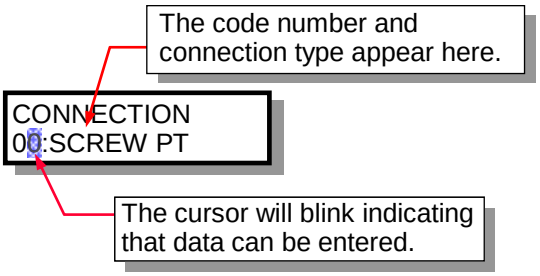
1. For a connection size of 40 mm, enter 0 4 0.
   For a connection size of $1^1/_2$ in., enter 1 5 0.
   (Values must be entered in decimal format.)
2. Press ↑ ↓ to confirm the data and move to the next or previous item.



NOTE:
The default for this item is 000. When you enter new inspection data on the TM, the value for this item will be 000.
Changing this item to a different value makes the new value the default. Once you change the value for a trap by the procedure above, any new traps you add will default to the new value for this item.

9.2.17 Display/edit connection specification

This item is used to select the steam trap connection type.
If you do not wish to enter or revise the code, press ↓ to move to the next item.

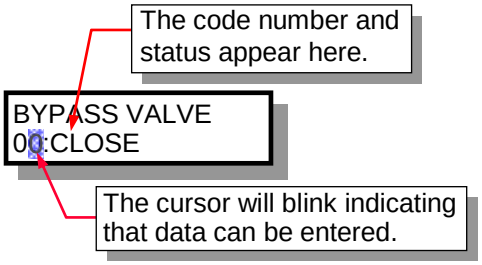


1. Press CALL JUDGE MODIFY JUDGE to select the connection type.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 99: Unspecified. When you enter new inspection data on the TM, the code for this item will be 99.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.18 Display/edit bypass valve information

This item is used to display or edit Information about the steam trap's Bypass Valve.
If you do not wish to enter or revise the code, press ↓ to move to the next item.

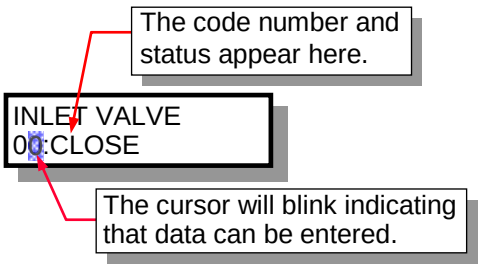


1. Press CALL JUDGE MODIFY JUDGE to select the status of the Bypass Valve
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 99: Unspecified. When you enter new inspection data on the TM, the code for this item will be 99.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.19 Display/edit inlet valve information

This item is used to display or edit Information about the steam trap's Inlet Valve.
If you do not wish to enter or revise the code, press ↓ to move to the next item.

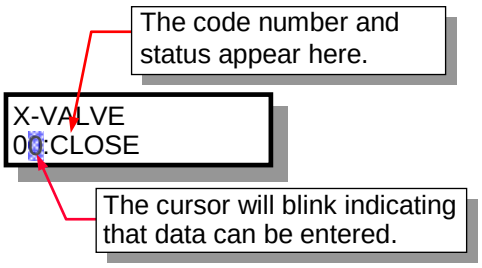


1. Press CALL JUDGE MODIFY JUDGE to select the status of the Inlet Valve
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 99: Unspecified. When you enter new inspection data on the TM, the code for this item will be 99.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.20 Display/edit isolation valve (X-valve) information

This item is used to display or edit information about the steam trap's isolation valve.
If you do not wish to enter or revise the code, press ↓ to move to the next item.

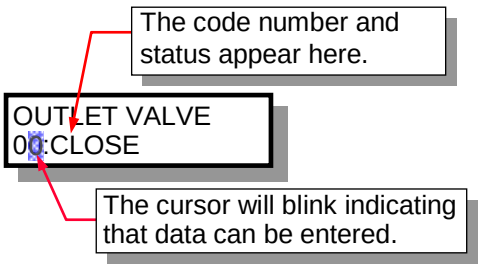


1. Press CALL JUDGE MODIFY JUDGE to select the status of the Isolation Valve
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 99: Unspecified. When you enter new inspection data on the TM, the code for this item will be 99.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.21 Display/edit outlet valve information

This item is used to display or edit Information about the steam trap's outlet valve.
If you do not wish to enter or revise the code, press ↓ to move to the next item.



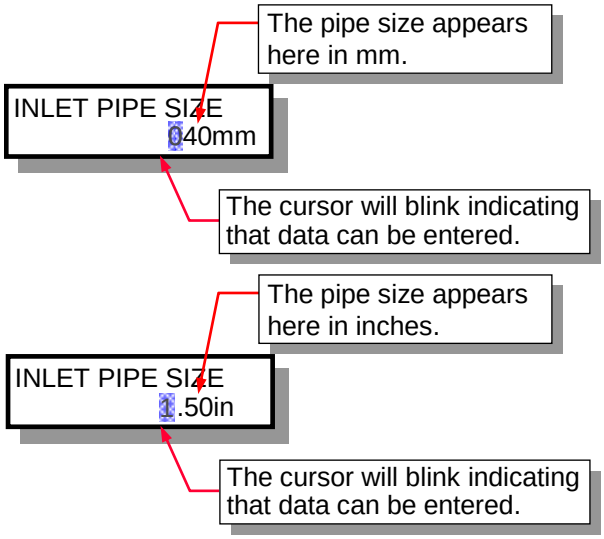
1. Press CALL JUDGE / MODIFY JUDGE to select the status of the Outlet Valve
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 99: Unspecified. When you enter new inspection data on the TM, the code for this item will be 99.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.22 Display/edit inlet pipe size

This item is used to display or edit the steam trap's inlet pipe size.
If you do not wish to enter or revise the value, press ↓ to move to the next item.

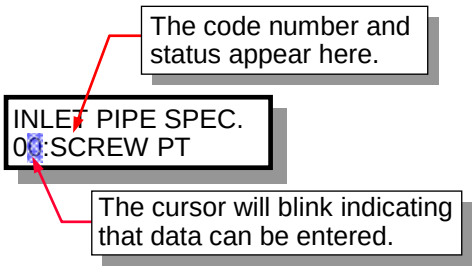
1. For an Inlet Pipe size of 40 mm, enter 0 4 0.
   For an Inlet Pipe size of 1 1/2 in., enter 1 5 0.
   (Values must be entered in decimal format.)
2. Press ↑ ↓ to confirm the data and move to the next or previous item.



NOTE:
The default for this item is 000. When you enter new inspection data on the TM, the value for this item will be 000.
Changing this item to a different value makes the new value the default. Once you change the value for a trap by the procedure above, any new traps you add will default to the new value for this item.

9.2.23 Display/edit inlet pipe specification

This item is used to display or edit the steam trap's inlet pipe specification.
If you do not wish to enter or revise the code, press ↓ to move to the next item.

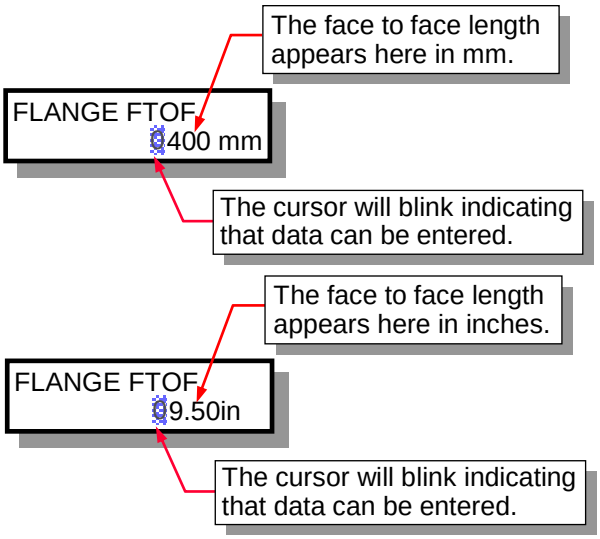


1. Press CALL JUDGE MODIFY JUDGE to select the inlet pipe's specification type.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 99: Unspecified. When you enter new inspection data on the TM, the code for this item will be 99.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.2.24 Display/edit flanged connection face to face length

This item is used to display or edit the face to face length for a steam trap with flanged connections.
If you do not wish to enter or revise the value, press ↓ to move to the next item.

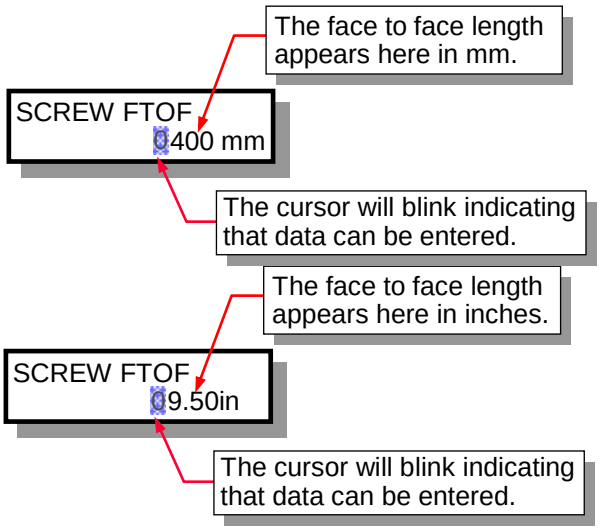


1. For a face to face length of 400 mm, enter 0 4 0 0.
   For a face to face length of 9.5 in., enter 0 9 5 0.
   (Values must be entered in decimal format.)
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is 0000. When you enter new inspection data on the TM, the value for this item will be 0000.
Changing this item to a different value makes the new value the default. Once you change the value for a trap by the procedure above, any new traps you add will default to the new value for this item.

9.2.25 Display/edit screwed connection face to face length

This item is used to display or edit the face to face length for a steam trap with screwed connections.
If you do not wish to enter or revise the value, press [↓] to move to the next item.

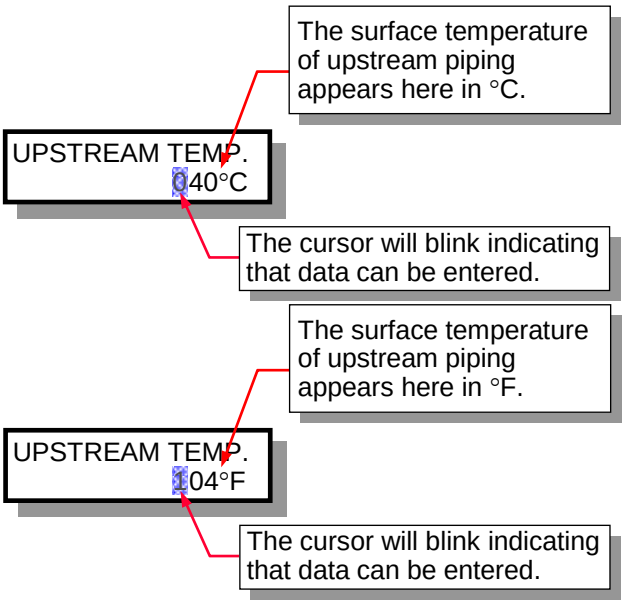


1. For a face to face length of 400 mm, enter [0][4][0][0].
   For a face to face length of 9.5 in., enter [0][9][5][0].
   (Values must be entered in decimal format.)
2. Press [↑][↓] to confirm the data and move to the next or previous item.

NOTE:
The default for this item is 0000. When you enter new inspection data on the TM, the value for this item will be 0000.
Changing this item to a different value makes the new value the default. Once you change the value for a trap by the procedure above, any new traps you add will default to the new value for this item.

9.2.26 Display/edit upstream temperature

This item is used to display or edit the surface temperature of piping upstream of the steam trap.
If you do not wish to enter or revise the value, press [↓] to move to the next item.

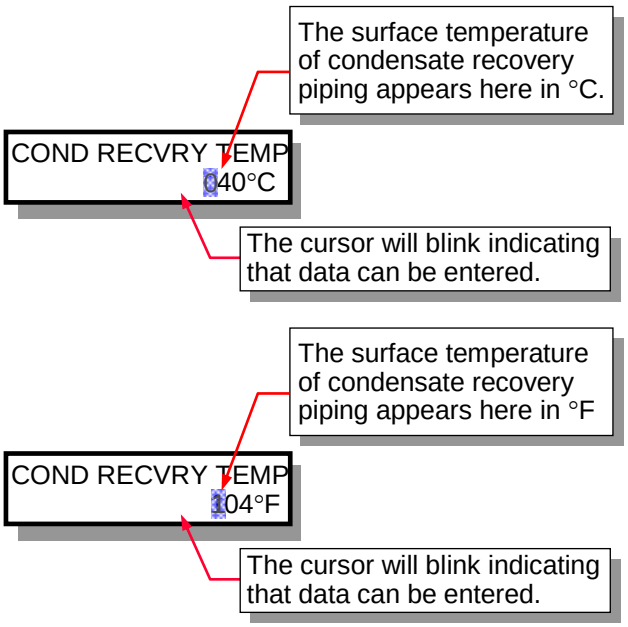


1. For a temperature of 40 °C , enter [0][4][0].
   For a temperature of 104 °F, enter [1][0][4].
2. Press [↑][↓] to confirm the data and move to the next or previous item.

NOTE:
The default for this item is 000. When you enter new inspection data on the TM, the value for this item will be 000.
Changing this item to a different value makes the new value the default. Once you change the value for a trap by the procedure above, any new traps you add will default to the new value for this item.

9.2.27 Display/edit condensate recovery temperature

This item is used to display or edit the surface temperature of the condensate recovery piping at the outlet side of the steam trap.
If you do not wish to enter or revise the value, press ↓ to move to the next item.

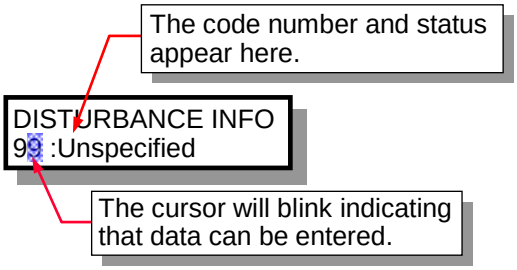


1. For a temperature of 40 °C, enter 0 4 0.
   For a temperature of 104 °F, enter 1 0 4.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is 000. When you enter new inspection data on the TM, the value for this item will be 000.
Changing this item to a different value makes the new value the default. Once you change the value for a trap by the procedure above, any new traps you add will default to the new value for this item.

9.2.28 Display/edit disturbance noise information

This item is used to display or edit information about ultrasonic waves caused by disturbances.
If you do not wish to enter or revise the code, press ↓ to move to the next item.

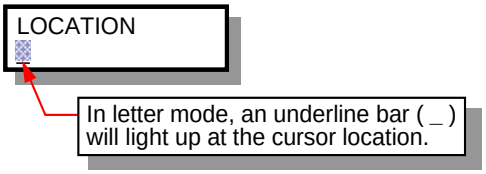


1. Press CALL JUDGE MODIFY JUDGE to select disturbance noise information.
2. Press ↑ ↓ to confirm the data and move to the next or previous item.

NOTE:
The default for this item is code 99: Unspecified. When you enter new inspection data on the TM, the code for this item will be 99.
Changing this item to a different code makes the new code the default. Once you change the code for a trap by the procedure above, any new traps you add will default to the new code for this item.

9.3 Entering Text

1. To enter numbers, simply press the numeric keys.



2. To change to text entry mode, press SHIFT.
   To enter a space, press LIGHT in text entry mode. To exit from text entry mode, press SHIFT again.

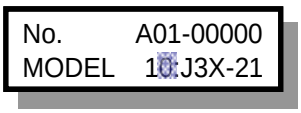
3. Press CALL JUDGE and MODIFY JUDGE to move the cursor. Note that in text entry mode these keys are used to enter the letters “D” and “F”.

CAUTION

Only letters and numbers may be entered. Letters are always entered as capital letters; lower case letters cannot be entered.
TLV recommends that you enter text on the PC.

10. For Added Convenience

- **Registering frequently inspected models ("10.1 Model Memory Function")**
  It is possible to register up to 30 models for each type of trap. This can be used to add new traps for inspection to the data sent from the PC. It is convenient for adding new traps for inspection without the need to enter trap codes.



(In this figure, 1257 has been entered to register TLV model J3X-21.)

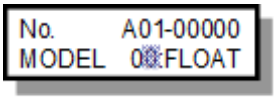
- **Finding trap codes ("10.2 Model Search Function")**
  This function is used to search for and display the trap model name by trap type and manufacturer. This is helpful when adding new traps for inspection at the worksite and adding traps with the model memory function.

- **Conserving battery power ("10.3 Auto Power OFF Function")**
  The power can be set to go off automatically if a period of five minutes elapses without any operation being performed. This helps to prevent the power from being left on, exhausting the battery.

10.1 Model Memory Function

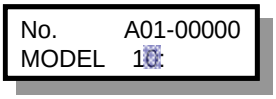
Up to 30 model names and codes may be registered for each trap type. Registered model names can be displayed in sequence by pressing the MODEL key for that type.

1. When the control number is currently displayed (and the cursor is not blinking)
   Press the MODEL key for the model you wish to enter (OTHERS | TEMP. ADJ | FLOAT | THERMO | BUCKET | DISC)
   Generic names registered for number 00 will be displayed for each model. These sample names cannot be changed.



(The screen shown here appears when FLOAT is pressed.)

2. Using the same MODEL key, or ↑ or ↓, change the registration number to the desired number. If a model name has previously been registered for that number, that name will appear.



(In this figure, registration number 10 has been selected)

3. Use the numeric keys to enter the 4-digit code for the model name you wish to register if you have it available (accessible in TrapManager Software from the Reports Menu and from individual trap information screens). To find the Model, you may press INFO and use the model search function to register the model name.
4. Repeat steps 2 and 3 if you wish to register model names for other numbers.
5. Pressing ENT registers the model name to the registration number displayed and also registers it to the control number displayed.

NOTE:
If you do not wish to change the model name already registered for the control number being displayed, do not press ENT Instead, press AREA NO. or TRAP NO. This registers the model

name without assigning it to a control number.
A learning feature has been included in the Model Memory Function so that more frequently used models will be displayed before less frequently used models regardless of the registration number sequence.

10.2 Model Search Function

1. Move the cursor to the model number you wish to register, using "10.1 the model memory function" procedure.
2. With the cursor blinking at the registration number, press INFO.
3. The trap manufacturers will be displayed. Press ↑ or ↓ until the manufacturer of the trap for which you wish to search appears.
4. Press ENT to display the model names for the selected manufacturer.
5. Press ↑ or ↓ until the model name you wish to register appears, then press ENT again. The model name will be registered to the corresponding registration number.

10.3 Auto Power OFF Function

A choice can be made to activate the Auto Power OFF Function so that if the TM is not used for 5 minutes (including actual measurements), the power will go OFF automatically. This conserves the TM power supply when moving between inspection sites or when the TM is stored or idle.

To set or cancel this function, press FUNC 5 as described in "8.4 Changing Settings".

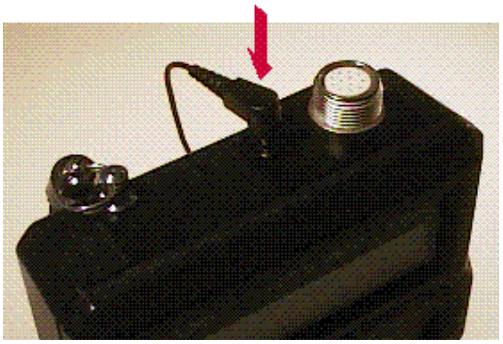
CAUTION

Auto Power OFF does not function in **DATA TRANS**, **FUNCtion** or **INFOrmation** modes, or during the control number entry process.

11. Using Accessories

11.1 Using the Earphone (TM5N (standard type) only)

The earphone included with the unit can be used to listen to the noise of trap operation. To use the earphone, insert the earphone jack into the connector on the top of the unit.



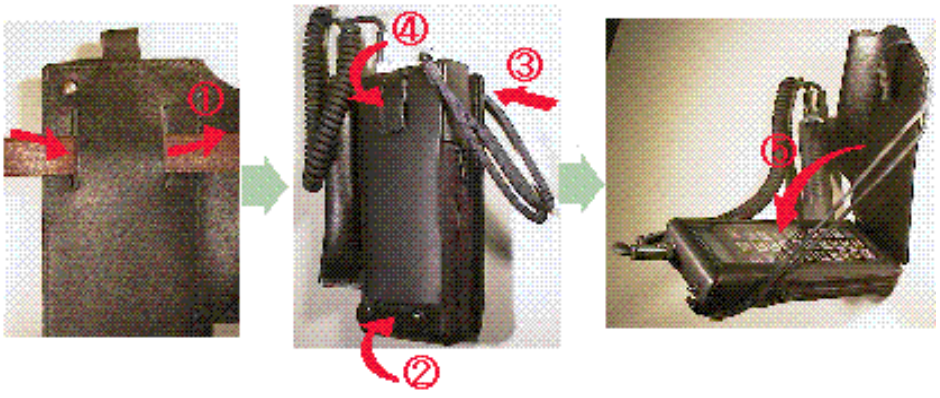
CAUTION

Loud noises or vibrations have the potential to cause deafness. Earphone volume is adjustable. To adjust the volume see "8.4 Changing Settings". Also, when measuring near rotating machinery, the earphone cord may become caught in the machinery; take measures to prevent this before starting measurement.

11.2 Using the Holster

You can use the holster to free both hands when moving between locations or to free one hand during measurement.

1. Pass your belt through the holster.
2. Snap the flap on the holster to the snaps on the bottom of the TM leather case.
3. Attach the strap on the TM to the hook on the back of the holster.
4. When moving between locations, fasten the Velcro connector on the top of the holster to the Velcro patch on the TM leather case. Insert the probe into the housing.
5. When conducting measurements, unfasten the Velcro connector on the top of the holster, making certain to attach the strap on the TM to the hook on the back of the holster.



11.3 Replacing the Main Battery

The main battery used by the TM is rechargeable, so it will almost never need to be replaced. If this becomes necessary for some reason, use the following procedure.

CAUTION

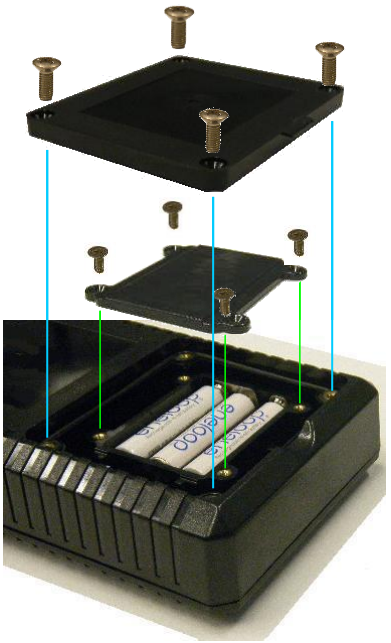
Use only eneloop AAA batteries.

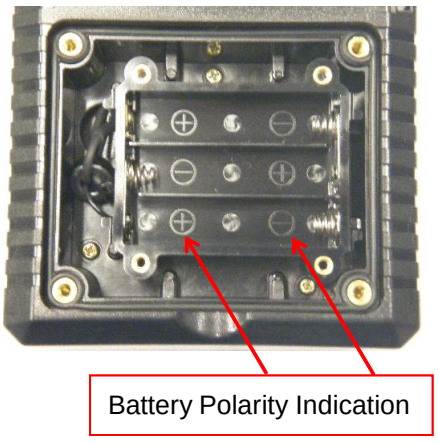
For the TM5N-EX (intrinsically safe), use only SANYO HR-4UTGB or Panasonic BK-4MCC (eneloop AAA) batteries.

Including TM5N-EX (intrinsically safe), remove/replace batteries in other than explosion hazard areas.

When replacing batteries, remove the old batteries and replace with new batteries.

1. Using a screwdriver, remove the four screws on the rear of the unit.
2. Remove the outer battery cover.
3. Unscrew the four screws on the battery box and remove the inner battery cover.
4. Remove the old batteries and replace with new batteries. Follow the polarity indications on the bottom of the battery box when inserting batteries.
5. Use screws to reaffix the inner battery cover on the battery box.
6. Replace the outer battery cover and tighten the screws in place.

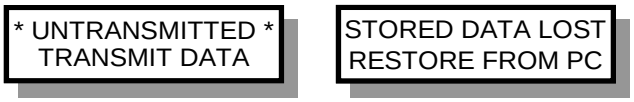




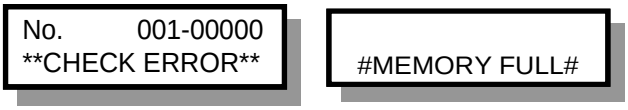
12. Troubleshooting

12.1 Error Messages

Immediately after power ON

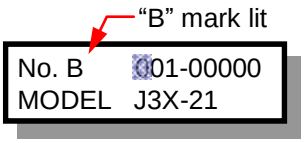


During measurement



During communications

Battery-related



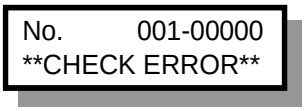
12.1.1 Untransmitted data

CAUSE
Some data remains to be transmitted. Measurement or transmitting data from PC to TM will cause this data to be overwritten or deleted.

PROCEDURE
Transmit the unsent data to the PC using the data communications function.
If the unsent data is not needed, simply press ENT.

12.1.2 Check error

CAUSE
The probe is not being pressed against the trap correctly, or the model name has not been entered.



PROCEDURE
Check the model name and then press the probe perpendicularly against the trap to measure.

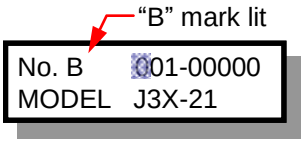
12.1.3 Communication error

CAUSE
An error of some kind occurred during data transmission between the TM and PC or PC and TM, preventing the data from being transmitted.

PROCEDURE
Check to make sure that the communications cable is securely connected and follow the instructions on the PC screen.
Press DATA TRANS to cause the error message to disappear.

12.1.4 "B" mark is lit

CAUSE
The main battery voltage is low.



PROCEDURE
Charge using the special charger.

12.1.5 Memory full

CAUSE
You have attempted to conduct more inspections than the number of inspection items that can be stored in the TM.

PROCEDURE
Send data to the PC to free up space.

12.1.6 Stored data lost

CAUSE
The data in the TM has been lost.

PROCEDURE
Restore the data from the PC. Trap Codes and Master Codes, etc., can be restored by downloading them from the PC.

If this procedure fails to correct the problem, contact your TLV sales representative.

12.2 Troubleshooting

When the unit does not operate as it should, check the following items.
If the unit still does not function properly even after these items have been checked and corrective action has been taken, contact your TLV sales representatives with a description of the problem.

12.2.1 The unit does not charge properly

Check the following and take the appropriate action.

1. Are you using the special charger?
2. Is the charging jack inserted securely in place?
3. Is the special charger plugged into an outlet?
4. Is electricity being supplied to the outlet?

12.2.2 The unit cannot be switched ON during charging

This is normal.

Once the charger jack is inserted, the power cannot be turned ON. Conversely, if the charger jack is inserted with the power ON, the power will go OFF.

12.2.3 Nothing appears on the display even when the ON key is pressed

Check the following and take the appropriate action.

1. Is the battery charged?
2. Sometimes the power does not go ON if the key is pressed too briefly. Hold the key down longer (about one second).
3. Is the charger connected? The power cannot be turned ON during charging.
4. Is the contrast of the LCD too low?
   Perform the following operation after turning ON the power:
   To bring up the contrast control screen, press FUNC 5 ↓ ↓ ENT in that order, making sure that each key press is accompanied by a beep, then keep pressing ↑ until some text appears on the display.

12.2.4 The power does not go off even when the OFF key is pressed

This is probably normal; you probably need to hold the key down longer.

To prevent the unit from unintentionally being turned off, the OFF key must be held down for more than one second before the unit will go off.

12.2.5 The AREA NO, and TRAP NO. keys do not work

Check the following and take the appropriate action.

1. Is the "i" displayed indicating that the mode is set to **INFOrmation** mode?
2. Is the "f" displayed indicating that the mode is set to **FUNCtion** mode?

12.2.6 The MODEL keys do not work

Check the following and take the appropriate action.

1. Is the cursor blinking at the area or trap number position? Press ENT to confirm the control number and then try the operation.
2. Is the "i" displayed indicating that the mode is set to **INFOrmation** mode?
3. Is the "f" displayed indicating that the mode is set to **FUNCtion** mode?

12.2.7 Re-judgement using the SHIFT key does not work

Check the following and take the appropriate action.

1. Is the judgement displayed?
   Use CALL JUDGE to display the judgement and then try the operation.
2. Is the "i" displayed indicating that the mode is set to **INFOrmation** mode?
3. Is the "f" displayed indicating that the mode is set to **FUNCtion** mode?
4. Has the location been inspected and the data stored in the TM? Re-judgment can only be conducted after data collection.

12.2.8 The auto power OFF function does not work

Check the following and take the appropriate action.

1. Is the **Auto power OFF** setting enabled?
2. Is the mode set to **FUNCtion** or **INFOrmation** mode?
3. Is the cursor blinking at the area or trap number position?
   The Auto power OFF function is not effective in **FUNCtion or INFOrmation** mode, or during the **control number** entry process.

12.2.9 Measurement is not possible, or a measurement error occurs

Check the following and take the appropriate action.

1. Is the coiled cord connector loose?
2. Has the model name been entered?
3. Is the "i" displayed indicating that the mode is set to **INFOrmation** mode?
4. Is the "f" displayed indicating that the mode is set to **FUNCtion** mode?
5. Is the tip of the **probe** being held securely against and perpendicular to the trap?

12.2.10 The measured surface temperature is abnormally low

Check the following and take the appropriate action.

1. Has the **measurement surface** been filed smooth?
2. Is the tip of the **probe** being held securely against and perpendicular to the trap?

If these items are normal, try measuring with a commercial surface thermometer and compare the result with the TM value.

12.2.11 The tip of the probe does not return to its normal position

Check the following and take the appropriate action.

Is there dirt or other substance sticking to the tip of the probe? Carefully wipe away anything sticking to the tip and try measuring again.

12.2.12 Data cannot be sent to or received from the PC

Check the following and take the appropriate action.

1. Are you using the special communications cable?
2. Is the communications cable securely connected to both the computer and the TM unit?
3. Is the TM power ON?
4. Is the TM mode set to **DATA TRANS** mode?
5. Has the correct COM port been selected in the TrapManager software? Check the available COM ports on your computer and change the COM port setting so it matches one of the available COM ports. To do this, click the Setup tab on the Communications dialog box (accessed with Communications on the Utilities menu) and then click the radio button for the appropriate COM port.
   (Refer to TrapManager Quick Start Guide for details.)
6. (If downloading data) Have you clicked the Download button in the Download tab of the Communications dialog box in the TrapManager software? Have you also clicked **DATA TRANS** in the dialog box that appeared?

   (If uploading data) Have you clicked the Start button in the Upload tab? Have you also clicked **DATA TRANS** in the box that appeared?

   (If transferring data in the Other tab) Have you pressed both DATA TRANS on the TM unit and the appropriate buttons in the Other box of the Communications dialog box and in the other box (if any) that appeared?

12.2.13 Incorrect date and time is shown even after the setup

It is possible that the capacity of the backup battery has declined. In that case, the TM unit needs to be returned to TLV. Please contact TLV.

13. Specifications

MODEL	TM5N (Standard) TM5N-EX (Intrinsically Safe) ATEX: CE2776 Ex II 2G Ex ib IIB T3 Gb DEMKO 12 ATEX 1212672X EN IEC 60079-0:2018, EN 60079-11:2012 IECEx: EX ib IIB T3 Gb IECEx UL 12.0016X IEC 60079-0, 7th Edition, IEC 60079-11, 6th Edition UKEX: Ex ib IIB T3 Gb CML 21UKEX2641X BS EN IEC60079-0:2018, BS EN 60079-11:2012 The TM5N-EX is approved for use in hazardous locations only while inserted in the leather case (case name: TM5N-LC-EX). Do not remove the case while in a hazardous location. Product markings are provided on the product enclosure beneath the leather case. For hazardous locations, the TM5N-EX should be used by trained personnel with knowledge of the hazardous locations/classifications. Do not wipe/rub the surfaces of this product with a dry cloth etc. There is the danger of electrostatically charging the unit, which may result in fire or explosions, especially in explosion hazard areas. The maximum measured capacitance from the probe receptacle to ground is 14.3 pF. The user shall determine suitability in the specific application.
Nameplate (for TM5N-EX)	 TLV TrapMan MODEL TM5N-EX DATA PROCESSING EQUIPMENT FOR USE IN HAZARDOUS LOCATIONS Intrinsically safe when powered by 3 SANYO eneloop model HR-4UTGB or 3 Panasonic eneloop model BK-4MCC Class I, Zone 1,AEx ib IIB T3 Gb Ex ib IIB T3 Gb PATENTED CERTIFIED SAFETY US-CA E346614 CE 2776 II2G Ex ib IIB T3 Gb DEMKO 12 ATEX 1212672X CML 21UKEX2641X IECEx UL 12.0016X Ta: -20 to 40°C / -4 to 104°F UKCA 2503 EAC S.NO. TLV CO.,LTD 〒675-8511 Kakogawa Japan WARNING / AVERTISSEMENT 1. DO NOT open, disassemble, or make alterations. 2. DO NOT allow any part except the probe tip to come into contact with high temperature surfaces. 3. DO NOT remove leather case, part number TM5N-LC-EX,when in use and in presence of potentially explosive atmosphere. 4. For charging, use the battery charger provided. (battery charger has not been evaluated for cULus listing or ATEX/IECEx certification) 5. Read and understand TM5N/TM5N-EX instruction manual before use. 6. Battery charger : Ui=4.5V Ii=300mA USB connection : Ui=5V Ii=10mA 1. NE PAS ouvrir, démonter, ou faire des modifications 2. À l'exception de la pointe de la sonde, NE PAS laisser une pièce entrer en contact avec des surfaces à haute température 3. NE PAS enlever l'étui en cuir (référence TM5N-LC-EX) en cours d'utilisation et en présence d'une atmosphère potentiellement explosive 4. Pour recharger, utiliser le chargeur de batterie fourni (le chargeur de batterie n'a pas été évalué pour la liste cULus ou la certification ATEX/IECEx) 5. Lire attentivement le manuel d'instruction du TM5N/TM5N-EX avant de l'utiliser 6.Chargeur de batterie : Ui=4,5V Ii=300mA Branchement USB : Ui=5V Ii=10 mA The actual nameplate design may differ from the nameplate displayed above.

Measurement Range Surface Temperature Pressure Range	 0 to 350 °C (32 to 662 °F) 0.5 to 80 kg/cm^{2}G (7 to 999 psig)
Display	Dot-matrix LCD screen (with yellow backlight) 16 characters × 2 rows
External Interface	USB 2.0 Type B: Incoming voltage (Ui: 5 V), current (Ii: 10 mA) Battery charging: Incoming Voltage (Ui: 4.5 V), Current (Ii: 300 mA)
Power Main Power Backup Power	Ni-MH 3.6 V DC 750 mAh (eneloop AAA × 3) (For the TM5N-EX (intrinsically safe), use only SANYO HR-4UTGB or Panasonic BK-4MCC (eneloop AAA) batteries.) Maximum open circuit voltage: 3.9 V Non-rechargeable lithium battery (3.0 V 36 mAh)
Charging Time	Approx. 2 hours (special charger with protection against overcharge)
Continuous Operation Time	After battery has been fully charged: Approximately 10 hours (when backlight is not used) Approximately 8 hours (when backlight is used)
Operating Temperature / Humidity Range	-20 to 40 °C (-4 to 104 °F) 20 to 80% RH
Dimensions Body Probe	 92 mm (W) × 213 mm (H) × 34 mm (D) $3^5/_8$ in. (W) × $8^3/_8$ in. (H) × $1^{11}/_{32}$ in. (D) 32 mm (ø) × 185 mm (L) $1^1/_4$ in. (ø) × $7^9/_{32}$ in. (L)
Weight Body Probe and coiled cord	 Approximately 500 g (1.1 lb) Approximately 390 g (0.86 lb)
Accessories	Special Charger, Earphone (TM5N (standard type) only), Leather Case (TM5N-LC-EX), Holster, Strap, USB communication cable, Flat file, Instruction manual, Pocket Guide, Carrying Case

14. Calibration

The tip of the probe, which is used to detect temperature and ultrasonic waves, is a crucial component. The detection sensitivity may change, not only if the probe is dropped or knocked about, but as a result of wear; therefore, periodic calibration is recommended.

TLV recommends that the TM be recalibrated every 2 years or after 30,000 measurements, whichever occurs first, or when the probe tip becomes warped or damaged.

Contact a TLV customer service representative.

15. TLV EXPRESS LIMITED WARRANTY

Subject to the limitations set forth below, TLV CO., LTD., a Japanese corporation ("**TLV**"), warrants that products which are sold by it, TLV International Inc. ("**TII**") or one of its group companies excluding TLV Corporation (a corporation of the United States of America), (hereinafter the "**Products**") are designed and manufactured by TLV, conform to the specifications published by TLV for the corresponding part numbers (the "**Specifications**") and are free from defective workmanship and materials. The party from whom the Products were purchased shall be known hereinafter as the "**Seller**". With regard to products or components manufactured by unrelated third parties (the "**Components**"), TLV provides no warranty other than the warranty from the third party manufacturer(s), if any.

Exceptions to Warranty

This warranty does not cover defects or failures caused by:

1. improper shipping, installation, use, handling, etc., by persons other than TLV, TII or TLV group company personnel, or service representatives authorized by TLV; or
2. dirt, scale or rust, etc.; or
3. improper disassembly and reassembly, or inadequate inspection and maintenance by persons other than TLV or TLV group company personnel, or service representatives authorized by TLV; or
4. disasters or forces of nature or Acts of God; or
5. abuse, abnormal use, accidents or any other cause beyond the control of TLV, TII or TLV group companies; or
6. improper storage, maintenance or repair; or
7. operation of the Products not in accordance with instructions issued with the Products or with accepted industry practices; or
8. use for a purpose or in a manner for which the Products were not intended; or
9. use of the Products in a manner inconsistent with the Specifications; or
10. use of the Products with Hazardous Fluids (fluids other than steam, air, water, nitrogen, carbon dioxide and inert gases (helium, neon, argon, krypton, xenon and radon)); or
11. failure to follow the instructions contained in the TLV Instruction Manual for the Product.

Duration of Warranty

This warranty is effective for a period of one (1) year after delivery of Products to the first end user. Notwithstanding the foregoing, asserting a claim under this warranty must be brought within three (3) years after the date of delivery to the initial buyer if not sold initially to the first end user.

ANY IMPLIED WARRANTIES NOT NEGATED HEREBY WHICH MAY ARISE BY OPERATION OF LAW, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ANY EXPRESS WARRANTIES NOT NEGATED HEREBY, ARE GIVEN SOLELY TO THE INITIAL BUYER AND ARE LIMITED IN DURATION TO ONE (1) YEAR FROM THE DATE OF SHIPMENT BY THE SELLER.

Exclusive Remedy

THE EXCLUSIVE REMEDY UNDER THIS WARRANTY, UNDER ANY EXPRESS WARRANTY OR UNDER ANY IMPLIED WARRANTIES NOT NEGATED HEREBY (INCLUDING THE IMPLIED

WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE), IS **REPLACEMENT**; PROVIDED: (a) THE CLAIMED DEFECT IS REPORTED TO THE SELLER IN WRITING WITHIN THE WARRANTY PERIOD, INCLUDING A DETAILED WRITTEN DESCRIPTION OF THE CLAIMED DEFECT AND HOW AND WHEN THE CLAIMED DEFECTIVE PRODUCT WAS USED; AND (b) THE CLAIMED DEFECTIVE PRODUCT AND A COPY OF THE PURCHASE INVOICE IS RETURNED TO THE SELLER, FREIGHT AND TRANSPORTATION COSTS PREPAID, UNDER A RETURN MATERIAL AUTHORIZATION AND TRACKING NUMBER ISSUED BY THE SELLER. ALL LABOR COSTS, SHIPPING COSTS, AND TRANSPORTATION COSTS ASSOCIATED WITH THE RETURN OR REPLACEMENT OF THE CLAIMED DEFECTIVE PRODUCT ARE SOLELY THE RESPONSIBILITY OF BUYER OR THE FIRST END USER. THE SELLER RESERVES THE RIGHT TO INSPECT ON THE FIRST END USER'S SITE ANY PRODUCTS CLAIMED TO BE DEFECTIVE BEFORE ISSUING A RETURN MATERIAL AUTHORIZATION. SHOULD SUCH INSPECTION REVEAL, IN THE SELLER'S REASONABLE DISCRETION, THAT THE CLAIMED DEFECT IS NOT COVERED BY THIS WARRANTY, THE PARTY ASSERTING THIS WARRANTY SHALL PAY THE SELLER FOR THE TIME AND EXPENSES RELATED TO SUCH ON-SITE INSPECTION.

Exclusion of Consequential and Incidental Damages

IT IS SPECIFICALLY ACKNOWLEDGED THAT THIS WARRANTY, ANY OTHER EXPRESS WARRANTY NOT NEGATED HEREBY, AND ANY IMPLIED WARRANTY NOT NEGATED HEREBY, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, DO NOT COVER, AND NEITHER TLV, TII NOR ITS TLV GROUP COMPANIES WILL IN ANY EVENT BE LIABLE FOR, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO LOST PROFITS, THE COST OF DISASSEMBLY AND SHIPMENT OF THE DEFECTIVE PRODUCT, INJURY TO OTHER PROPERTY, DAMAGE TO BUYER'S OR THE FIRST END USER'S PRODUCT, DAMAGE TO BUYER'S OR THE FIRST END USER'S PROCESSES, LOSS OF USE, OR OTHER COMMERCIAL LOSSES. WHERE, DUE TO OPERATION OF LAW, CONSEQUENTIAL AND INCIDENTAL DAMAGES UNDER THIS WARRANTY, UNDER ANY OTHER EXPRESS WARRANTY NOT NEGATED HEREBY OR UNDER ANY IMPLIED WARRANTY NOT NEGATED HEREBY (INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE) CANNOT BE EXCLUDED, SUCH DAMAGES ARE EXPRESSLY LIMITED IN AMOUNT TO THE PURCHASE PRICE OF THE DEFECTIVE PRODUCT. THIS EXCLUSION OF CONSEQUENTIAL AND INCIDENTAL DAMAGES, AND THE PROVISION OF THIS WARRANTY LIMITING REMEDIES HEREUNDER TO REPLACEMENT, ARE INDEPENDENT PROVISIONS, AND ANY DETERMINATION THAT THE LIMITATION OF REMEDIES FAILS OF ITS ESSENTIAL PURPOSE OR ANY OTHER DETERMINATION THAT EITHER OF THE ABOVE REMEDIES IS UNENFORCEABLE, SHALL NOT BE CONSTRUED TO MAKE THE OTHER PROVISIONS UNENFORCEABLE.

Exclusion of Other Warranties

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY DISCLAIMED.

Severability

Any provision of this warranty which is invalid, prohibited or unenforceable in any jurisdiction shall, as to such jurisdiction, be ineffective to the extent of such invalidity, prohibition or unenforceability without invalidating the remaining provisions hereof, and any such invalidity, prohibition or unenforceability in any such jurisdiction shall not invalidate or render unenforceable such provision in any other jurisdiction.

16. Service

For Service or Technical Assistance: Contact your TLV representative or your TLV office.

In Europe:

TLV EURO ENGINEERING GmbH
Daimler-Benz-Straße 16-18, 74915 Waibstadt, **Germany**
Tel: [49]-(0)7263-9150-0
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TLV EURO ENGINEERING UK LTD.
Units 7 & 8, Furlong Business Park, Bishops Cleeve, Gloucestershire GL52 8TW, **U.K.**
Tel: [44]-(0)1242-227223
Fax: [44]-(0)1242-223077

TLV EURO ENGINEERING FRANCE SARL
Parc d'Ariane 2, bât. C, 290 rue Ferdinand Perrier, 69800 Saint Priest, **France**
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In North America:

TLV CORPORATION
13901 South Lakes Drive, Charlotte, NC 28273-6790, **U.S.A.**
Tel: [1]-704-597-9070
Fax: [1]-704-583-1610

In Mexico and Latin America:

TLV ENGINEERING S. A. DE C. V.
Av. Jesús del Monte 39-B-1001, Col. Hda. de las Palmas, Huixquilucan, Edo. de México, 52763, **Mexico**
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Fax: [52]-55-5359-7585

In Oceania:

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Fax: [65]-6742 0345

TLV SHANGHAI CO., LTD.
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TLV ENGINEERING SDN. BHD.
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Fax: [60]-3-8051-0899

TLV PRIVATE LIMITED
252/94 (K-L) 17th Floor, Muang Thai-Phatra Complex Tower B, Rachadaphisek Road, Huaykwang, Bangkok 10310, **Thailand**
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TLV INC.
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In the Middle East:

TLV ENGINEERING FZCO
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Email: sales-me@tlv.co.jp

In Other Countries:

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881 Nagasuna, Noguchi, Kakogawa, Hyogo 675-8511, **Japan**
Tel: [81]-(0)79-427-1818
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Manufacturer:

TLV CO., LTD.
881 Nagasuna, Noguchi, Kakogawa, Hyogo 675-8511, **Japan**
Tel: [81]-(0)79-427-1800
Fax: [81]-(0)79-422-2277