INTERNATIONAL ROAD DYNAMICS INC.

LTPP WIM DATA COLLECTION SYSTEMS

WIM INSTALLATION PLAN FOR KANSAS SPS-2 LTPP ID 200200

February 13, 2006
CLIN 1002 TASK ORDER 7

Submittal For:
Federal Highways Administration

CONTRACT NO. DTFH61-05-D-00001

U.S. Department of Transportation
Federal Highway Administration

LONG TERM Pavement PERFORMANCE

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1 Coordination Activities

1.1 Contact Information

Debbie Walker (COTR)
FHWA LTPP
ph: 202-493-3068
e: deborah.walker@fhwa.dot.gov

Basel Abukhater (RSC)
Stantec
ph: 716-632-0804

Kirk Fredrichs (Division Representative)
FHWA
ph: 785-267-7299 x326

Bill Hughes
Kansas DOT
ph: 785-296-6863
e: bhughes@ksdot.org

Bruce Myers
International Road Dynamics (Phase 2 Contractor)
ph: 717-264-2077
c: 717-860-1817
e : bruce.myers@irdinc.com

1.2 Correspondence

December 20, 2005, Phone conversation Bill Hughes:
Kansas DOT to provide lane closure, lane close can be done during daylight hours. Discussed tentative installation schedule.

January 9, 2006, Phone conversation Bill Hughes:
FHWA will be sending specification for grinding.

January 232006, Phone conversation Bill Hughes:
Has not received grinding specification, I told him FHWA said he should be receiving them next week.

----- Original Message -----
From: Bruce Myers
To: Bill Hughes
Sent: Friday, January 27, 2006 10:06 AM
Subject: Fw: LTPP WIM I-70 WB MP 287.5

Bill,

For your review please find the proposed site drawings and pull box specification for the LTPP WIM site on I-70. Should you have any questions please contact me.

Thanks

Bruce Myers
Sales/ Project Manager
IRD PAT Traffic
Ph: (717) 264-2077 Fax:(717) 264-4941
www.irdinc.com
IRD is Customer Driven!

2 Site Drawings

2.1 SPS Site Location Information

This plan will detail where and how the SPS site will be instrumented with a bending plate WIM system. This site is located in Kansas along highway I-70, in the outside westbound lane at mile marker 287.5. The WIM Site is 1500 feet downstream of SPS Test Section 200212 and 700 feet upstream of SPS Test Section 200211. The Site is located in Dickinson County.

EXISTING ROADWAY SURROUNDING THE PROPOSED WIM SITE

Type Pavement: PCC

Pavement Age: 14 years old

Lane Width: 12 feet

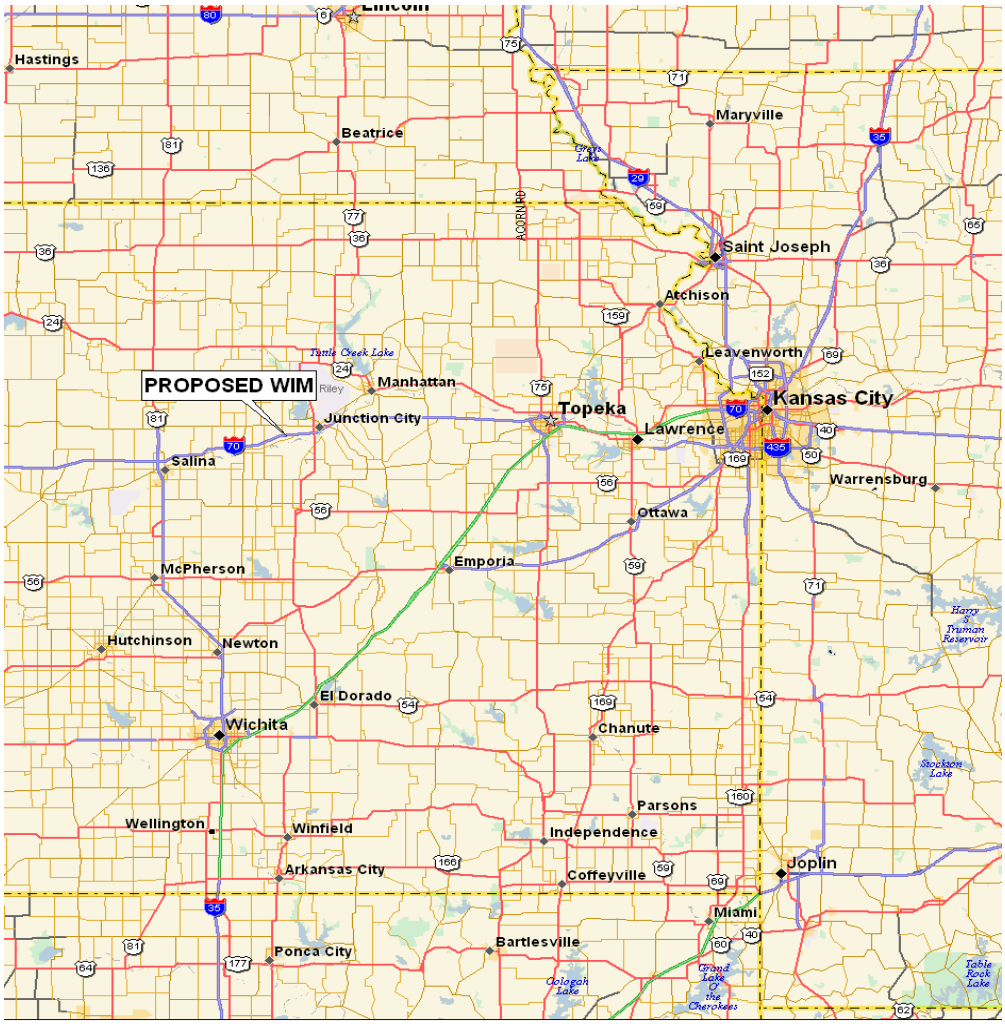
Thickness: 12 inches

Outside WB Shoulder Type: PCC

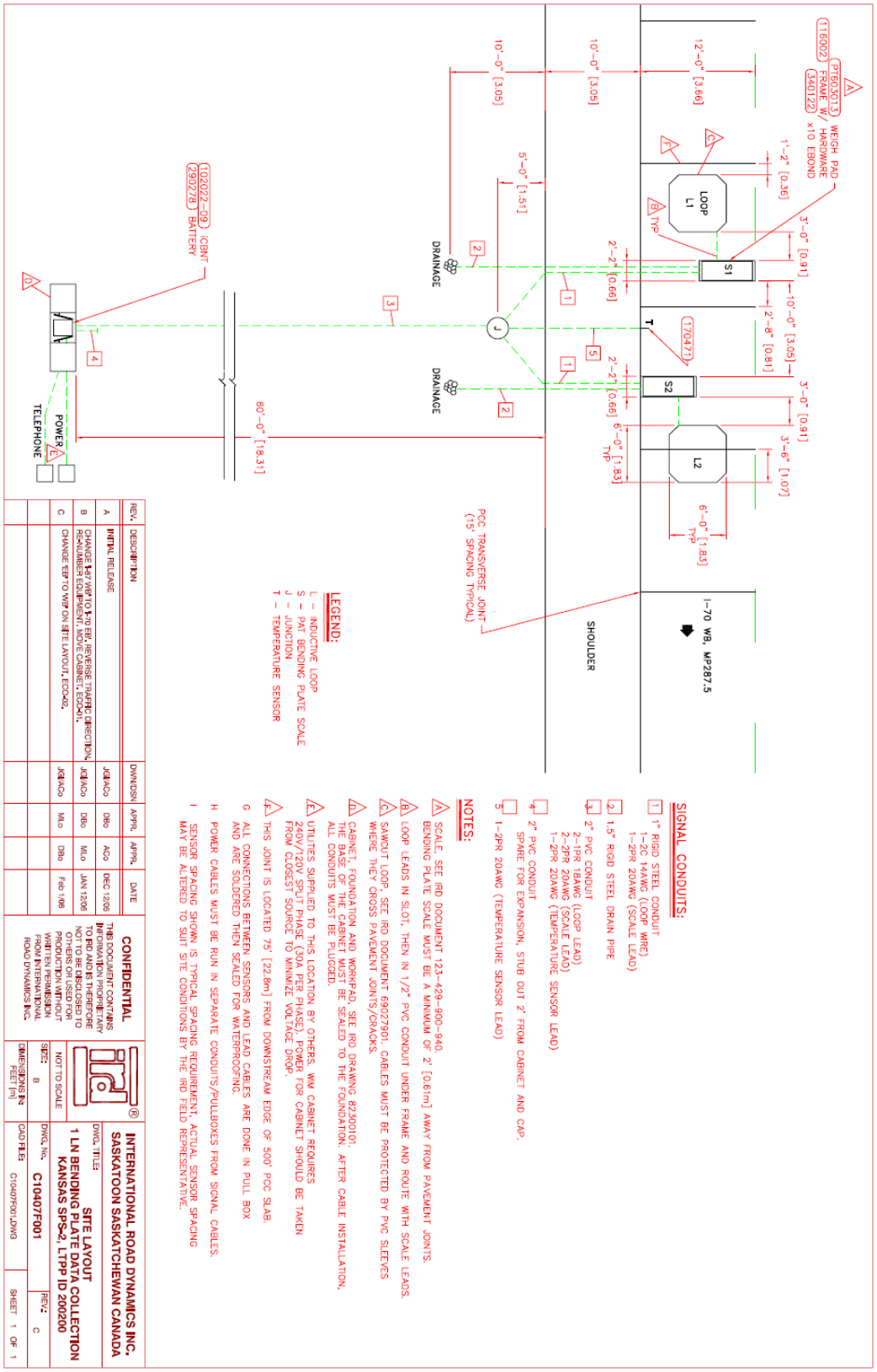
Width: 10 feet

PAVEMENT 325' PRIOR AND 75' FOLLOWING WIM SCALE LOCATION

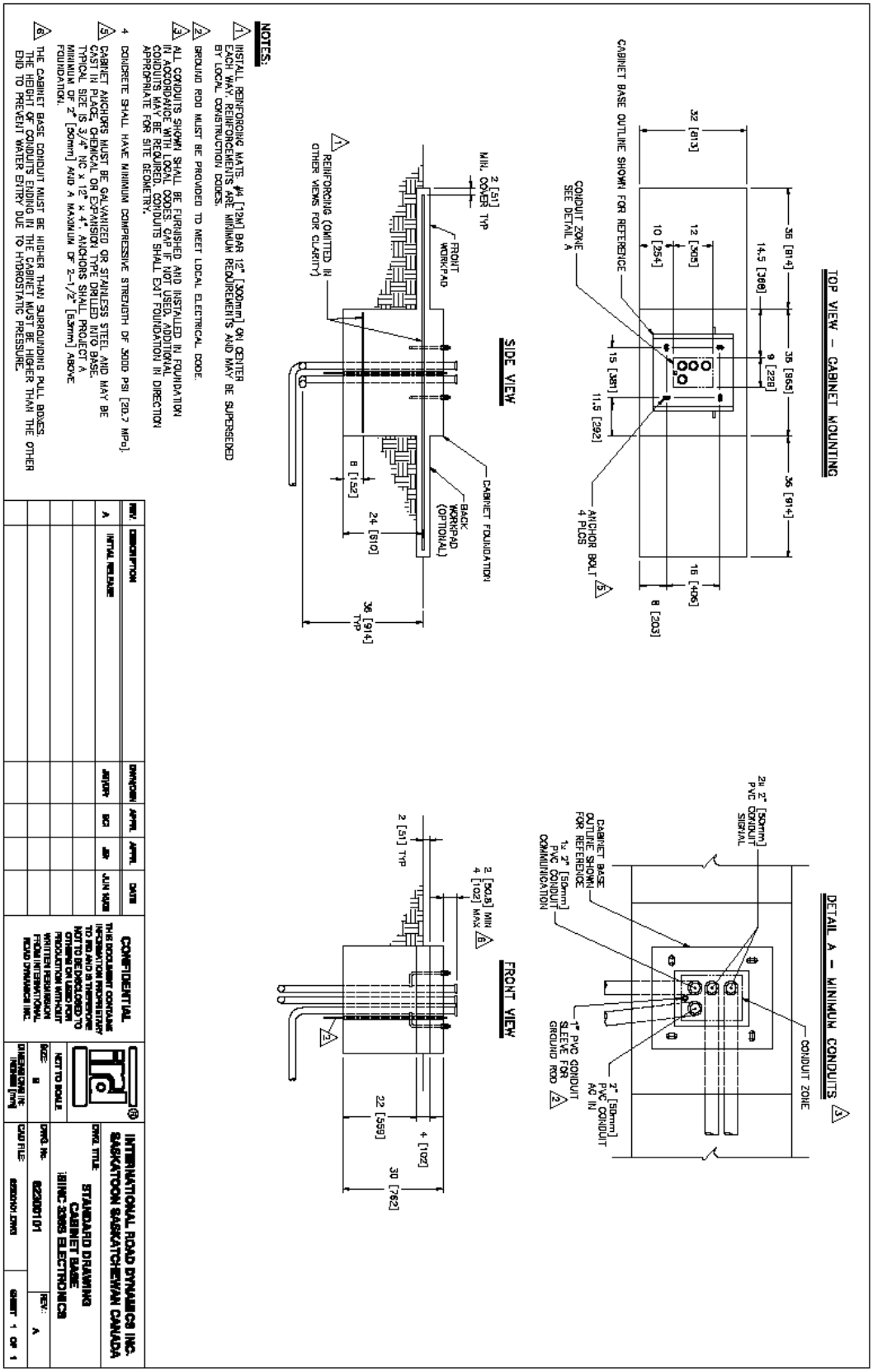
Type: PCC Thickness: 14 inches Jointed or Continuous: Jointed (15 - 16 ft joints) – dowelled



2.2 Site Layout



2.3 Cabinet Base



3 Kansas Traffic Control Plan

3.1 Traffic Plan To Be Used

Traffic Control shall be provided by the Kansas DOT and shall conform to all State regulations. The estimated cost of traffic control is $4000.

4 iSINC

4.1 iSINC Technical Specifications and Brochure

iSINC SYSTEM ELECTRONICS
WIM TECHNICAL SPECIFICATIONS

GENERAL

The iSINC Weigh-In-Motion (WIM) System Electronics is an integrated vehicle information processing package that implements sensor input signal conditioning, system software to transform the inputs into the required outputs and a user interface. The System Electronics consist of a WIM Control Unit, Sensor and Output Modules to interface the various devices specific to a site's requirements, terminal panels with over-voltage protection and isolation for each input and output line, system controlled AC power outputs and an integral Power Supply, all housed within a weatherproof enclosure.

The system software is pre-loaded and automatically starts when the system is powered up. The electronics use a modular design based on the Controller Area Network (CAN) communication bus for easy of maintenance, troubleshooting and in-field servicing.

iSINC WIM CONTROL UNIT DETAILS

Communication:

-CAN Bus environment for very extensive sensor and control configuration
-On-board Ethernet interface
- One RS-232 serial interface dedicated to external system interface
- One RS-232 serial interface dedicated to remote administration facilities (modem dial-in)
- Local user interface for system configuration and fault diagnosis
- Remote administration via Telnet
- Remote file download via FTP

Peripherals:

-Non-volatile storage for vehicle information to prevent data loss during power outages: Compact Flash cards from a minimum of 32 MB up to 4 GB
- Sensor inputs from SLC, SSWIM, Bending Plate, Kistler, Piezo, Dynax, Serial and Digital devices
- Output control options for a wide variety of Serial, Digital and AC powered devices (CMS, VMS, OCS, LCS, DMS, printers, signal lights, toll gates, etc.)

Software:

-Processes up to eight lanes of traffic
-Records data logs on operational status, power supply condition, and safety system activity
-Weight Compliance and Classification with user-definable classification scheme
-Serial output compatible with HELP, I75 and others
-Compatibility with IRD's complete line of optional application specific software packages:
-Automated Ramp Weigh Station
-Automated Mainline Weigh Station
-Data Analysis and Reporting

User Interface

-Local through a handheld keypad or laptop PC in terminal mode
-Remote through a dial-up modem to a PC in terminal mode
-Telnet over the Ethernet interface

SENSOR AND CONTROL MODULE DETAILS

Each module includes built in signal conditioning. All sensor modules are field replaceable. Every module features self testing and built in fault diagnosis.

Scale Sensor Module
-Three lanes of SLC, SSWIM or PAT Bending Plate scales
-One lane of IRD Bending Plate scales

Piezo/Kistler Sensor Module
-Four piezoelectric sensor inputs plus temperature sensor
-Class 1 or Class 2 sensors
-Four Kistler sensor inputs plus temperature sensor

Digital I/O Module
-Eight isolated contact closure inputs or outputs
-Report on rising edge, falling edge or both
-Adjustable input debounce
-Control output state, single pulse, or square wave
-Adjustable timeout on inputs

Serial Control Module
-RS232C compatible asynchronous serial port for communication with serial devices such as printers and VMS

Serial Bridge Module
-RS232C compatible asynchronous serial port for devices communicating directly with the CAN Bus

Loop Sensing Module
-Four magnetic sensing loop inputs
-Adjustable for sensitivity and frequency

iSINC ENCLOSURE DETAILS

The iSINC electronics enclosure houses the following components:
-WIM control Unit
-One or two chassis for iSINC modules; each chassis accommodates up to 10 modules
- I/O Signal Panels with terminals and over-voltage protection for each channel
-iSINC controlled AC power outputs with 4 channels per panel
-Power supply
- All components mounted in a 19” rack
-Brushed aluminum panels
-Enclosure size required is dependant on the options selected for an installation. The available sizes are:
- 117 cm high x 61 cm wide x 52 cm deep (46 in. x 24 in. x 20 in.)
-170 cm high x 61 cm wide x 76 cm deep (67 in. x 24 in. x 30 in.)
-Multiple enclosures may be connected together for expansion up to 160 modules

iSINC POWER SUPPLY DETAILS

Power Supply
-30 Watts supply. Power consumption varies with the options selected, but typically is in the range of 5 Watts

-90 to 264 VAC, 47 to 63 Hz operation
-Surge protection
-One GFI and three AC duplex outlets for peripheral equipment
-Optional Solar power, 40 W to 85 W panels
-Optional 12 VDC battery for backup or extended operation (up to 30 days). Integral charge controller for battery conditioning

SYSTEM EXPANDABILITY

The iSINC Electronics may be expanded with any combination of the above modules up to a maximum of 160 modules per installation. Each enclosure accommodates up to 20 modules; multiple enclosures may be connected together for larger installations. Using the built-in Ethernet or a Serial Bridge Module for expansion and connection of multiple WIM Control Units, expansion at a single location is virtually unlimited.

We make highways talk™

- *MANAGEMENT*
- *SAFETY*
- *PRESERVATION*

International Road Dynamics Inc. develops and maintains traffic management products and systems technology that make highways talk. What are they saying? They are providing information that roadway administrators need to manage traffic, preserve infrastructure and provide safety warnings to drivers.

IRD's multi-discipline, innovative and customer-focused team is expert in advanced technologies, advanced traffic solutions and custom-designed systems.

CUSTOMER DRIVEN™

INTERNATIONAL ROAD DYNAMICS INC.

www.irdinc.com

iSINC Systems Electronics

The iSINC Electronics forms the core of IRD's traffic and truck Weigh-In-Motion (WIM) systems, controlling numerous functions and processes for multiple applications. The iSINC is designed to accommodate new and future applications.

Features

- **Advanced Design**
- **Modularity and Convenience**
- **Powerful Software**

- **Commercial Vehicle Operations (CVO)**
- **Virtual Weigh Stations**
- **Traffic Data Collection**
- **Safety Systems**
- **Border Crossing and other ITS Applications**

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iSINC SYSTEMS ELECTRONICS
Specifications

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iSINC WIM CONTROL UNIT DETAILS

- Processor: 32-bit RISC
- Memory: 32 MB RAM, 32 MB Flash
- I/O: 10/100BASE-T Ethernet
  - Modem Port
  - Terminal Port

COMMUNICATION
- CAN Bus environment for very extensive sensor and control configuration
- On-board Ethernet interface
- One RS-232 serial interface dedicated to external system interface
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PERIPHERALS
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- Surge protection
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4.2 Cabinet Specifications

Rack Mount

IRD #580065

Mfg #RM462420

APX Enclosures, Inc.

RACK MOUNT

APPLICATION - NEMA 3R

APX Enclosures, Inc. 3R 19" rack mount enclosures are designed to house electronic controls, terminals, and instruments, and to provide protection from rain, sleet, snow, dripping water and corrosion, while providing ventilation.

APPLICATION - NEMA 4X

APX Enclosures, Inc. 4X 19" rack mount enclosures are designed to house electronic controls, terminals, and instruments, and to provide protection from rain, sleet, snow, dripping water and corrosion, as well as hosedown, splashing water, oil or coolant seepage.

INDUSTRY STANDARD:

U.L. Type 3R, 4X

A. ENCLOSURE:

1. The complete enclosure is made from .125" thick aluminum alloy type 5052-H-32 to provide a strong and rigid construction. Alternative material is 14 gauge type 304 stainless steel. (Specifier must choose the material to be used.)
2. Each enclosure is equipped with bracket provisions for rigid mounting of an optional EIA 19" rack frame assembly for mounting components. (See page C8 for E.I.A. rack specifications and catalog numbers.)
3. The door frame opening is double flanged on all four sides. These flanges increase the strength of the door opening and help prevent dust and liquids from dropping into the enclosure when the door is opened.
4. All exterior seams are ground smooth or sealed weathertight with silicone sealant.
5. All hardware is either stainless steel or aluminum.
6. Each (3R only) enclosure has provisions for mounting a forced-air fan system that can be thermostatically controlled, and air is exhausted through a screened vent system in the enclosure top.

B. DOOR: (Front-hinge on left, rear-hinge on right)

1. Equipped with three-point latching mechanism with nylon rollers at the top and bottom.
2. The door handle is .75" stainless steel round bar and has provisions for a padlock.
3. (3R only) The standard main door lock is Corbin #1548 -1 or equal.
4. (3R only) A louvered air vent with reusable metal filter and retaining brackets is provided.
5. The main door is sealed with closed-cell neoprene gasket.
6. The continuous door hinge is .075" thick stainless steel with a .25" stainless hinge pin.

C. FINISH:

1. Natural aluminum enclosures are mill finish per federal specification QQA-250/8.

NEMA 3R SHOWN

Optional rack frame shown installed

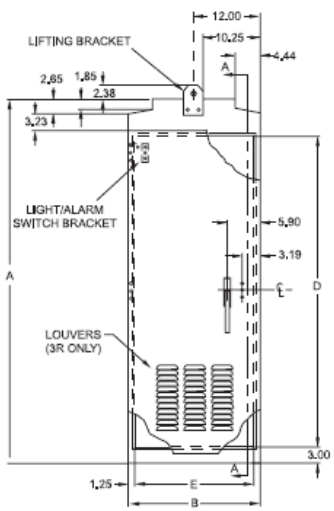
2. Painted enclosures are treated with an iron phosphate coating and dried by radiant heat. The standard finish coat is baked polyester powder.

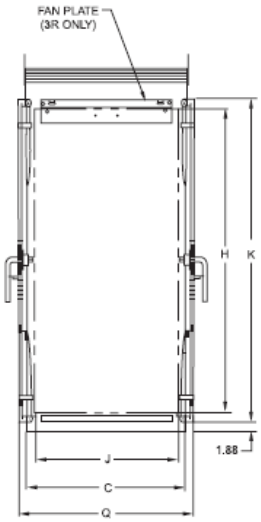
FOR NEMA TYPE 4X RATING:
DELETE *all vents and main door lock (Corbin #1548-1), and switch compartment assembly.*
ADD *all through holes are sealed.*

APX Enclosures, Inc.

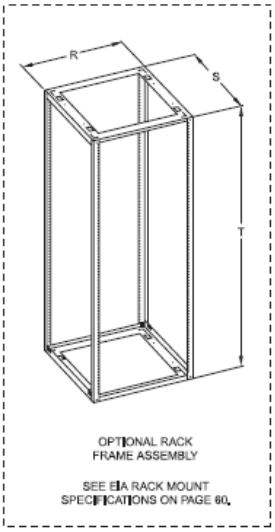
Rack Mount Enclosure

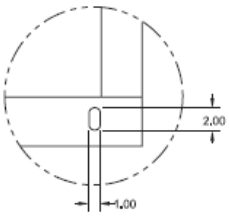
RACK MOUNT ENCLOSURE



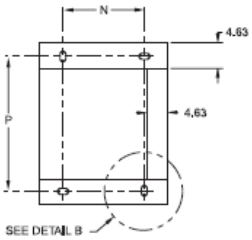


SECTION A-A





DETAIL B

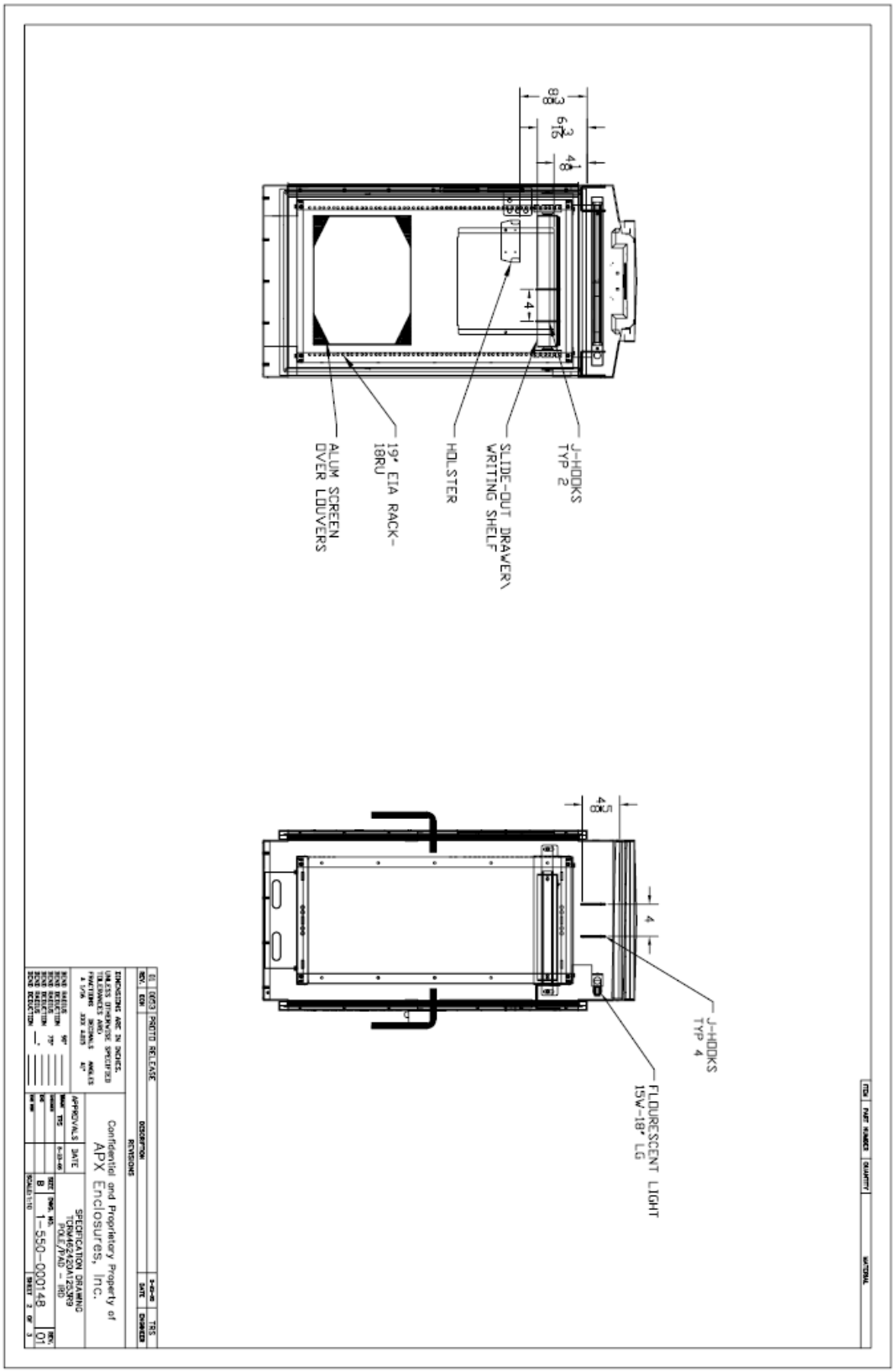


PAD MOUNTING PATTERN

OPTIONS:

- Locks: Keying, Other Than Standard
- Rack Frame Assembly
- Switch Compartment
- Custom Equipment Mounting
- Climate Control
  - Air Conditioner
  - Sunshields
  - Insulation
  - Heater
  - Forced-Air Ventilation Fan (3R only)

CATALOG NUMBER	SUGGESTED MOUNTING OPTIONS			CABINET			DOOR OPENING		SWITCH COMPARTMENT LOCATION		AVAILABLE SPACE		DOOR HEIGHT	PANEL		PAD MTG. PATTERN		GENERAL INFORMATION			
	PED	POLE	PAD	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T
RM392420	YES	YES	YES	39.00	24.00	20.25	9.00	21.50	OPTIONAL		25.75	16.50	31.25	N/A	N/A	15.00	15.00	22.75	20.00	15.75	27.25
RM462420	NO	YES	YES	46.00	24.00	20.25	36.00	21.50	OPTIONAL		32.75	16.50	38.25	N/A	N/A	15.00	15.00	22.75	20.00	15.75	34.25
RM463026	NO	YES	YES	46.00	30.00	26.25	36.00	27.50	OPTIONAL		32.75	22.25	38.25	N/A	N/A	21.00	21.00	28.50	20.00	20.75	34.25
RM553026	NO	YES	YES	55.00	30.00	26.25	44.00	27.50	OPTIONAL		41.75	22.25	47.25	N/A	N/A	21.00	21.00	28.50	20.00	20.75	43.25
RM672430	NO	NO	YES	67.00	24.00	30.00	57.00	21.50	OPTIONAL		53.75	26.25	59.25	N/A	N/A	15.00	25.00	32.50	20.00	20.75	55.25
RM672438	NO	NO	YES	67.00	24.00	38.00	57.00	21.50	OPTIONAL		53.75	34.25	59.25	N/A	N/A	15.00	33.00	40.50	20.00	29.25	55.25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18RU
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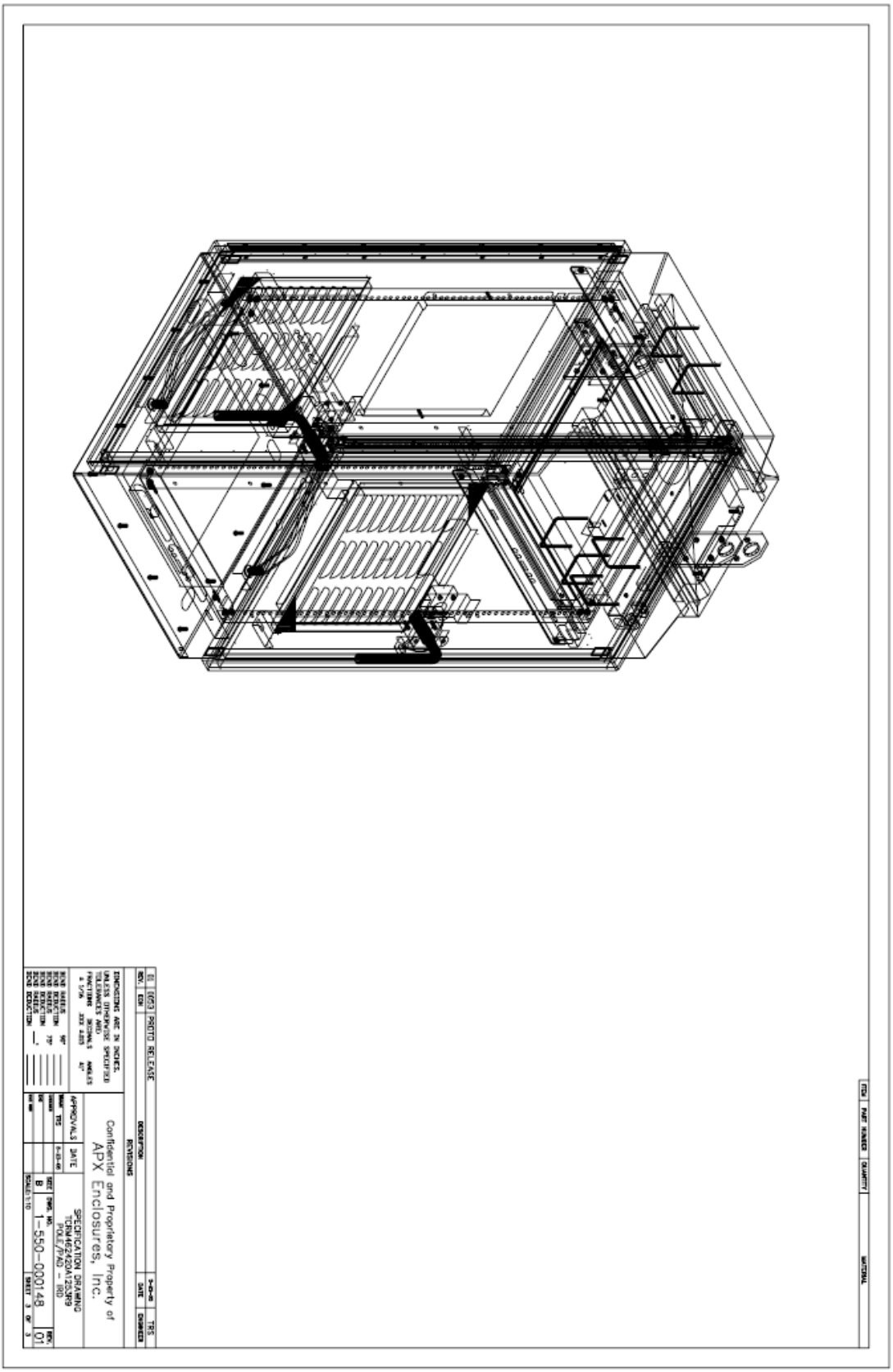
SHEET 1 OF 3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SHEET 3 OF 3

4.3 Operator's Manual

4.3.1 Introduction

4.3.1.1 Scope

This manual describes the components of the IRD iSINC Data Collection system, normal operation of the system and outlines some basic maintenance and trouble-shooting. It deals in detail with the components of the iSINC controller assembly. This manual does not cover assembly, installation or configuration procedures for the component parts of the Data Collection system. Refer to section 4.3.3, References, for sources of this information.

4.3.1.2 System Overview

The IRD iSINC (intelligent Systems Interface and Network Controller) Data Collection system is a reliable, automatic data collection system that determines vehicle weights and dimensions, classifies the vehicles according to a pre-defined set of criteria and stores the vehicle records for future analysis.
The IRD iSINC Data Collection system consists of two groups of components: the in-road sensors and the iSINC data processing system.
The in-road sensors for each lane of traffic being monitored consists of a Weigh-In-Motion scale to determine axle weights, axle sensors to determine the axle spacings and detection loop sensors to track vehicle progress through the system.
The iSINC processor takes all the input from the sensors, calculates weights, axle separations, speed, vehicle classification and potential violations, and outputs the resulting vehicle record to the datafiles stored on the system.

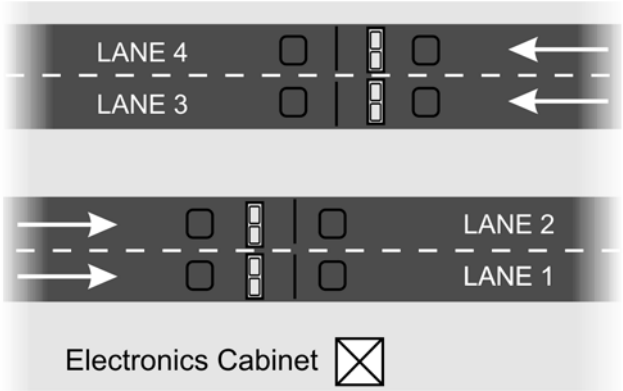


Figure 1- iSINC data collection system

The iSINC is a self contained sensor and interface controller that integrates all the system components. The iSINC electronics are enclosed in a secure, weather resistant cabinet. Also in the cabinet are the power connections, power supplies, input connections for the sensors, over voltage protection and optional modem and network connections. With the modem or network connection the system can be accessed and maintained remotely.
The IRD iSINC Data Collection system will weigh trucks at speeds between 10 and 250 kph (6 and 155 mph) with a minimum axle spacing of 60 cm. (24 inches).
The system is designed to function with minimal maintenance in an all-weather environment with minimal operator input.

4.3.2 Conventions

Labels on system components or of items displayed on the workstation monitor (window titles, lists, buttons, etc.) are printed in **Bold**.
Anything that is to be typed in on the workstation keyboard or handheld terminal keypad is enclosed in angle brackets < > and printed in ***Bold Italic***.
Any items of special note are printed in *italic*, with a ***Note:*** header.

4.3.3 References:

- IRD iSINC Data Collection System Installation Manual 821002
- ASTM E1318-02 Standard Specification for Highway Weigh-in-Motion (WIM) Systems with User Requirements and Test Methods
- NTCIP 1206 V01.18 Feb. 2002 Object Definitions for Data Collection and Monitoring (DCM) Devices (Draft), National Transportation Communications for ITS Protocol
  http://www.ntcip.org/library/documents document 1206

4.3.4 System Components

4.3.4.1 Electronics Cabinet

The electronics cabinet houses the iSINC processor, the termination panels for the signal and power cables, the breaker panel, and the internal wiring and components to interconnect the parts of the system. If the system is equipped with the optional solar/battery power source, the batteries and charging control circuitry are located in the cabinet. The electronics are housed in a 46” x 24” x 20” weather resistant metal cabinet.

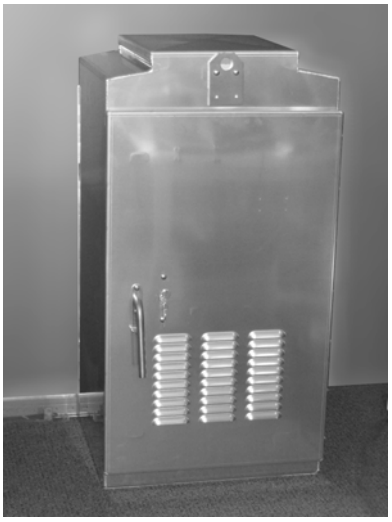


Figure 2 - Electronics cabinet

The electronics cabinet contains the rack mounted system hardware.

Figure 3 - Typical electronics system hardware

The component layout of the front on the assembly is illustrated in Figure 4:

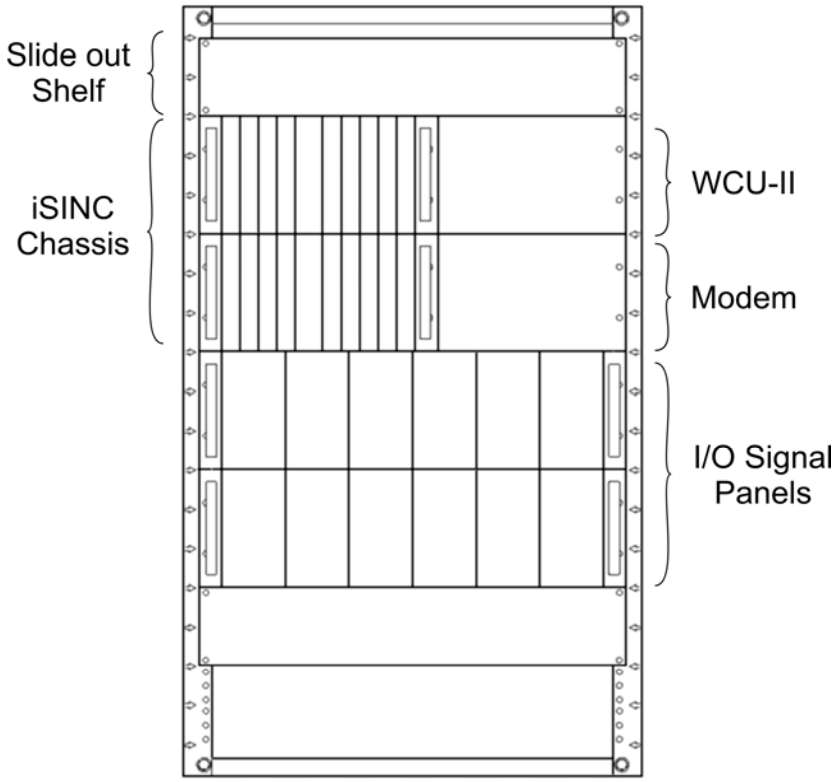


Figure 4 – Typical panel locations in rack assembly

The sections below give a more detailed description of the components in the electronics cabinet and their operation.

4.3.4.2 iSINC Controller

The iSINC (intelligent Systems Interface and Network Controller) receives all inputs from the sensors, processes the raw inputs into vehicle records and outputs the vehicle records to a data file.
The iSINC is made up of a 3U 42HP sub-rack chassis that houses the signal processing modules and the WIM Control Unit (WCU) that mounts beside it. The WCU is the processor that configures the system, controls system operations, handles external communications and stores vehicle data.
Note: *The iSINC Data Collection system uses the uprated WCU-II controller. In this manual the terms WCU and WCU-II are used interchangeably.*
The chassis has slots for up to ten electronics cards (modules), a CAN Bus backplane and the plug-in electronics modules that handle the signals to and from the various sensors. The modules that are present in an iSINC system will depend on which optional sensors are installed with the system. The iSINC also retains system performance data and diagnostics that are accessed through a hand held keypad terminal, a PC operating in terminal mode, or a remote computer connection.

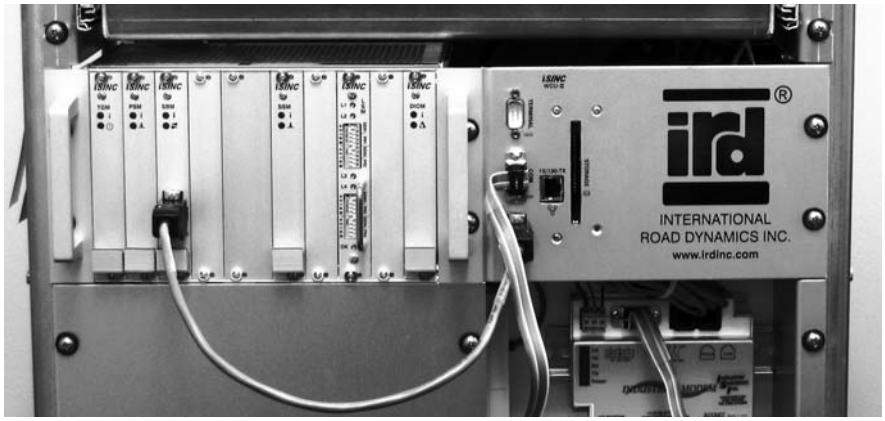


Figure 5 – iSINC controller

The front of the iSINC is made up of the face plates for the component modules. Depending on which options are installed with the system, some face plates illustrated may not be present. Blank panels cover the slots in the iSINC case with no modules installed.

Each module contains firmware to identify signals on the CAN Bus that are relevant to the module, process the input signals it receives, place the results of its processing on the CAN Bus, and take the appropriate action for any messages on the CAN Bus that it has been programmed to respond to.

The iSINC system operates on **Events**. An event may be triggered by an input from one of the sensors, by an input from the communications interface (network or terminal), by the end of a time interval or by another event message on the CAN Bus. An event may cause a message to be broadcast on the CAN Bus. When an event message is put on the bus, each module examines the message to determine whether or not it needs to take any action. If so, the module reads the message, does the required processing, and, if necessary, outputs the results to the appropriate destination (CAN Bus, communications port or signal channel).

4.3.4.3 iSINC CAN Bus Backplane

Signals between modules in the iSINC chassis are put on the CAN Bus backplane. Each module (card) plugs into an edge connector attached to the backplane. The position of the edge connectors corresponds to the slide in slots for the cards.

The iSINC is configured so that the slot number where each module is located in the chassis corresponds to the connections for the various system inputs and outputs on the Signal I/O panels; any given slot must be occupied by a specific card type to function correctly (i.e. cards of different types may not swap positions). A card may be replaced with another of the same type.

Each card in the system is uniquely identified by a Unit Identification number (UID). The UID is made up of two parts:
Card position – the slot number between 0 and 9 that the module occupies in the iSINC chassis.

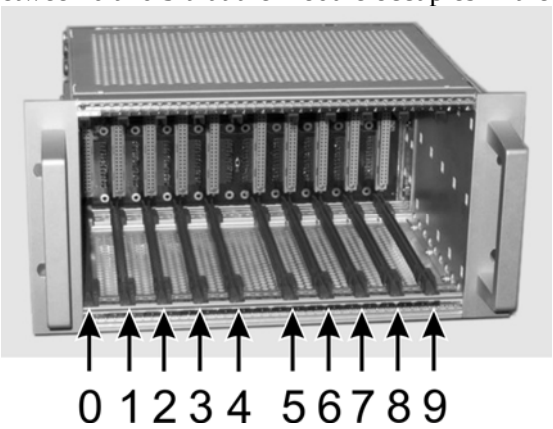


Figure 6 - iSINC UID slot numbering

Specific slots are designated for specific card types in each iSINC chassis. Refer to Appendix A.1.4 for a table listing of the system options available.
Chassis ID – each iSINC chassis in a system is identified by the 4 element DIP switch located on the CAN Bus backplane. The 4 bits of the switch settings make up the chassis ID part of the UID. The first chassis (topmost in the electronics cabinet) ID is number 0; if an additional chassis is required, it will have the ID number 1.

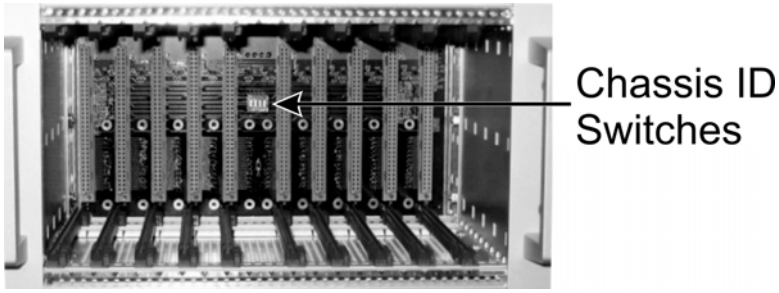


Figure 7 - iSINC chassis ID switches

On the rear side of the backplane are the 4 pin power connector and the 24 pin ribbon cable connectors for each slot in the chassis. Through a backplane ribbon connector, the module in a slot is connected to one of the Signal I/O panels for communication with external devices.

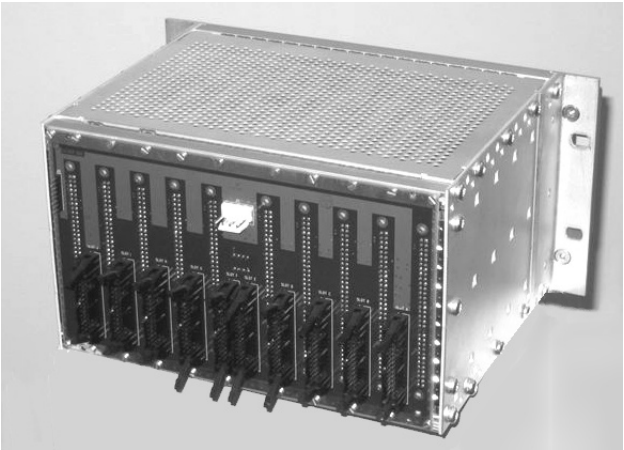


Figure 8 - Rear view of iSINC chassis

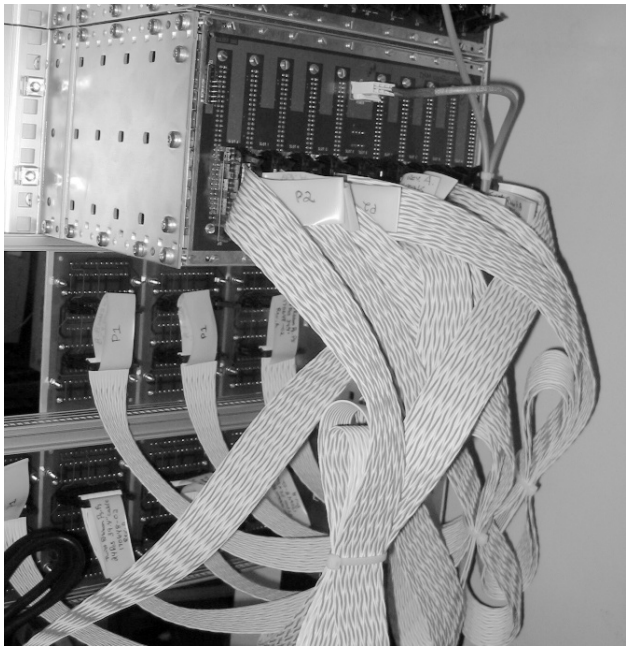


Figure 9 - Ribbon cables connecting backplane to I/O panels

4.3.5 iSINC Modules

4.3.5.1 WCU

The WIM Control Unit stores and runs the program that controls the system, records system data, and communicates with other computers.
The WCU is mounted on a separate 3U 42 HP panel that fits adjacent to the iSINC chassis in the mounting rack.

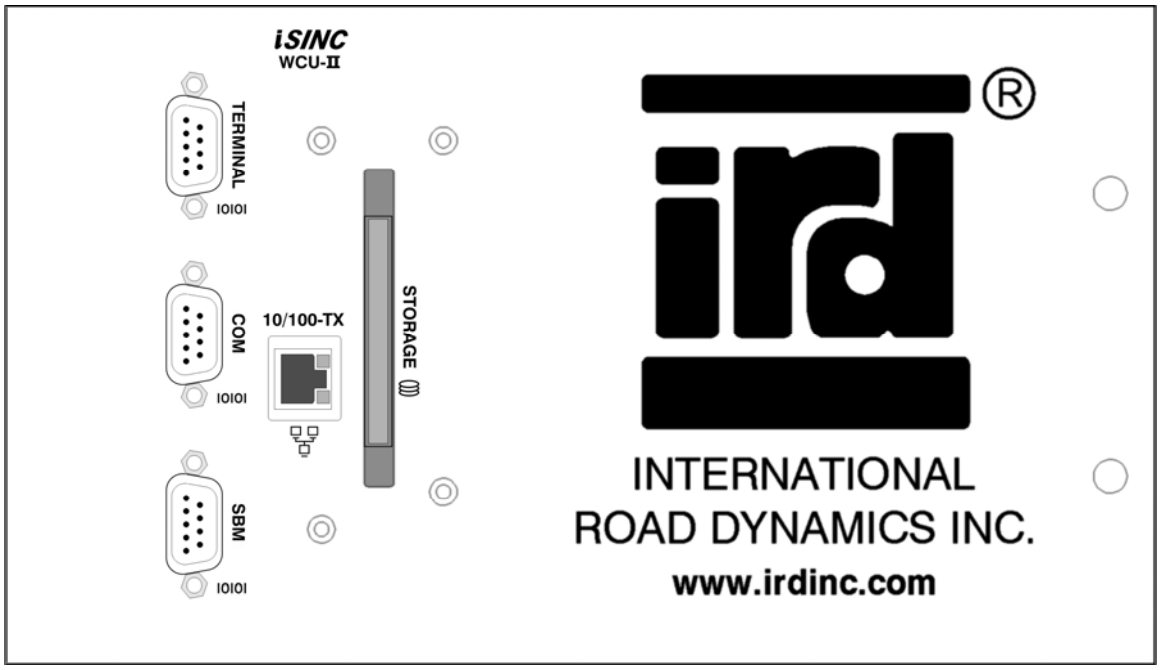


Figure 10 – WCU panel

The WCU communicates with iSINC chassis CAN Bus through an SBM in slot 2 of the iSINC chassis connected to the port labeled **SBM** on the WCU panel.
The removable memory flash card (labeled **Storage**) holds the database of vehicle records produced by the system. It also contains the system configuration settings.
The RJ45 connector labeled **10/100-TX** provides a 10 baseT Ethernet connection (refer to section 4.3.10.4 for details)
The connector labeled **Terminal** provides a serial connection link to a local terminal (refer to section 4.3.10.1).
The connector labeled **COM** provides a serial communications link for a remote connection through an optional modem (refer to section 4.3.6.1)
The connector labeled **SBM** is a serial link between the WCU and the iSINC CAN Bus.

4.3.5.2 TGM

The Timing Generation Module provides the synchronizing pulse for all other system modules and keeps accurate time for the system.

Figure 11 - TGM faceplate

The TGM supplies the time synchronization for all other modules in the system and the current date and time as the count of seconds from midnight (00:00:00) on January 1st, 1970. Time resolution is .25 milliseconds (1 "tick").

Inputs:

- Current time/date
- Requests for time of day

Outputs:

- Time synchronization event (every second)
- Time of day

The lower LED, labeled ⏲, will flash every second to indicate that the clock is running.

4.3.5.3 SSM

The Scale Sensor Module handles signals to and from single load cell or bending plate weigh-in-motion scale platforms to produce an axle weight.

Figure 12 - SSM faceplate

An SSM can process the signals for up to six weigh scale sensors. The excitation signals to and load signals from the scale sensors are connected to the iSINC through a Signal I/O panel (refer to section 4.3.5.8).
The SSM is programmable for the following values:

- Type of weighing sensor: single load cell, bending plate or slow speed weigh-in-motion sensor.
- Threshold – input value above which weight sampling will begin.
- Debounce factors – the lengths of time (in ticks) after the input signal rises above threshold or falls below threshold to wait before switching states (from sampling to not sampling or vice versa).

Inputs:

- Signals from up to 6 weight sensor (between 0 and 5 volts)

Outputs:

- Weight
- Time that the weight samples were taken

The sensor inputs should be in the range 0 to 5 volts. The analog input signals are converted to a 12 bit (0 to 4095) digital value.

The lower LED, labeled ⊥ will light whenever a weight is reported.

4.3.5.4 PSM

The Piezo Sensor Module processes signals from Piezoelectric Class 1 axle sensors, Piezoelectric Class 2 weigh-in-motion sensors, Kistler weigh-in-motion sensors and from temperature sensors.

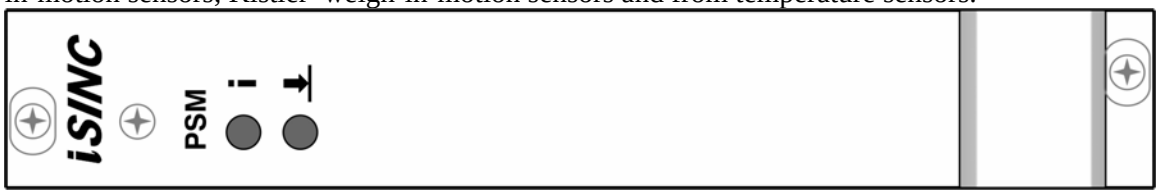


Figure 13 - PSM faceplate

It can process the signals for up to four piezo sensors plus one temperature sensor. The excitation signals to the temperature sensor and input signals from the piezo and temperature sensors are connected to the iSINC through a Signal I/O panel (refer to section 4.3.5.8).
The PSM is programmable for the following values:

- Type of piezoeletric sensor: Class I, Class II, Kistler.
- Threshold – input value above which an axle is detected (weight sampling will begin for Class I sensors).
- Debounce factors – the lengths of time (in ticks) after the input signal rises above threshold or falls below threshold to wait before switching states.

Inputs:

- Signals from up to 4 weight sensors (between 0 and 1 volts)
- A temperature sensor signal

Outputs:

- Weight
- Time that the weight samples were taken

The sensor inputs should be in the range 0 to 1 volts. The analog input signals are converted to a 12 bit (0 to 4095) digital value.
The lower LED, labeled ⊥ will light whenever an axle is detected or vehicle weight is reported.

4.3.5.5 LSM

The Loop Sensing Module detects a vehicles presence in an inductive detecting loop.

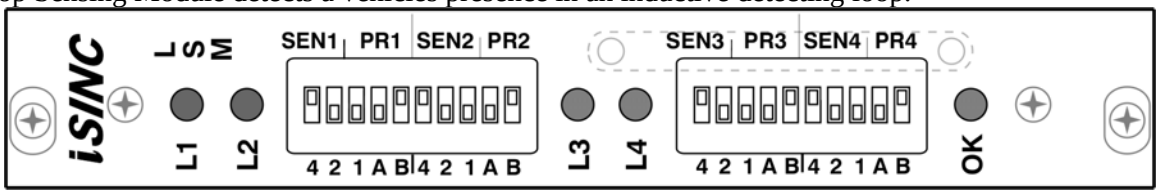


Figure 14 - LSM faceplate

The LSM is different from other modules in that it does not report the results of its sensor inputs on the CAN Bus. It receives the input signals from the sensing loops and transforms them into digital signals which are transmitted to the Digital I/O module via jumper wires between the LSM and DIOM I/O Signal Panels (refer to Appendix 0).

The LSM can process the signals from up to four sensing loops. The indicator lights on the LSM faceplate labeled **L1**, **L2**, **L3** and **L4** will light when a vehicle passes over the loop associated with the light.

The LED labeled **OK** will be on if the loops are operating normally. If the LED is off there is a problem with one of the loops.

The two blocks of DIP switches adjust the sensitivity of the loops and operating mode of the loop detectors; the switch settings shown in the illustration above (sensitivity of 4, presence B) should produce consistent detection of most vehicles. Refer to Appendix A.1.5 for a detailed description of the operations of the LSM switches.

Inputs:

- Signals from up to 4 magnetic sensing loops

Outputs:

- Digital signals for the DIOM

4.3.5.6 SBM

The Serial Bridge Module connects the CAN Bus to another serial communication device, such as the WCU or another iSINC chassis in a system where more than eight modules are required.

Figure 15 - SBM faceplate

The lower LED, labeled ▼, will flash when the serial link is active.

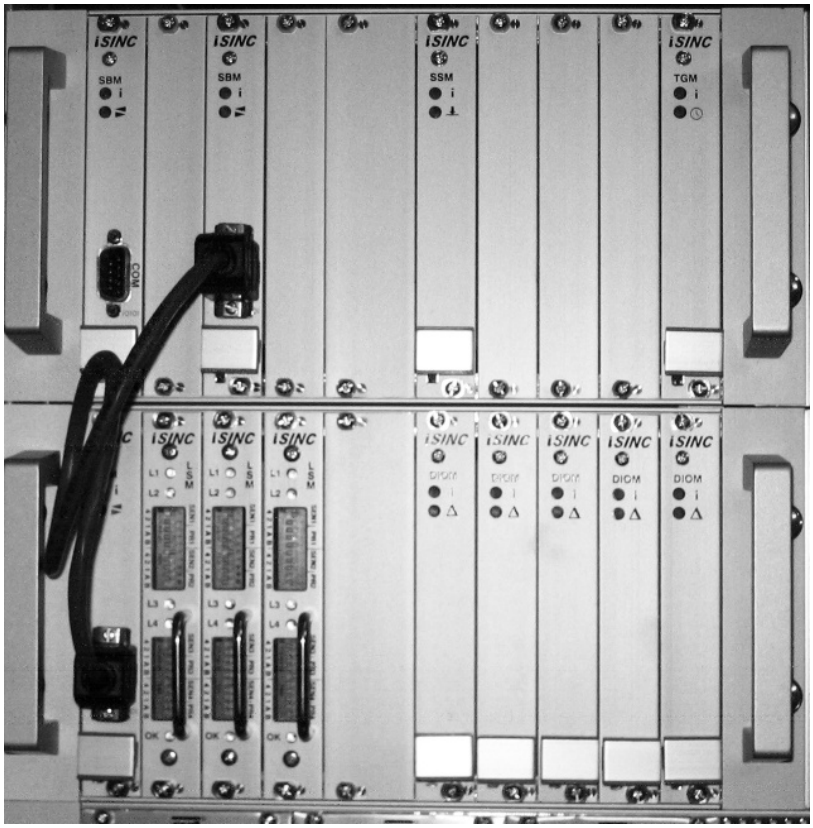


Figure 16 - Two iSINC units joined via SBM modules

4.3.5.7 DIOM

The Digital Input/Output Module handles all the digital signals to and from the iSINC. These include:

Dynax axle sensors (after signal conditioning by the Dynax input panel)
Sensing loops (after signal conditioning by the Loop Sensing Module)

Figure 17 - DIOM faceplate

The input and output signals to and from the DIOM are connected to the iSINC through a Signal I/O panel (refer to section 4.3.5.8).
Each channel of a DIOM can be set independently. The DIOM is programmable for the following values:

- Debounce factors – the lengths of time (in ticks) after an input signal activates or deactivates to wait before switching states.

Inputs:

- Up to 8 digital loop signals output from LSMs
- Signals from up to 8 Dynax axle sensors or off-scale sensors (or combination thereof)

Outputs:

- "Vehicle entering sensor array" event if DIOM input is from the first magnetic sensing loop in the sensor array.
- Time (in .25 msec ticks) from when the first loop in the sensor array was triggered if DIOM input is from the second magnetic sensing loop in the sensor array.
- Time (in .25 msec ticks) from when the first axle triggered the axle sensor to current axle if DIOM input is from a Dynax is acting as an axle sensor or;
- "Off-scale" event if DIOM input is from a Dynax is acting as an off-scale sensor.

The lower LED, labeled Δ, will flash when any digital I/O signal changes (a vehicle enters or leaves a loop, a wheel rolls onto an axle sensor, an output signal is changed, an off-scale detected, etc.).

4.3.5.8 Signal I/O Panels

The Signal Input/Output panels serve as the connection point for the wiring from the various sensors and low voltage input and output devices that send signals to and receive signals from the iSINC. There will be a Signal I/O panel for each module that receives input from the sensors (e.g. LSM, SSM, PSM, DIOM). Up to six 3U height, 14 HP width panels will fit in a standard 84 HP width sub-rack chassis.
Each panel houses three 12 connector terminal blocks. Refer to Appendix A.1.2.1 for the terminal block connector number assignments for the I/O signal wiring for each type of module. The low voltage signal lines should be fitted with ferrules prior to attachment to the connector to enhance wire-to-connector reliability.

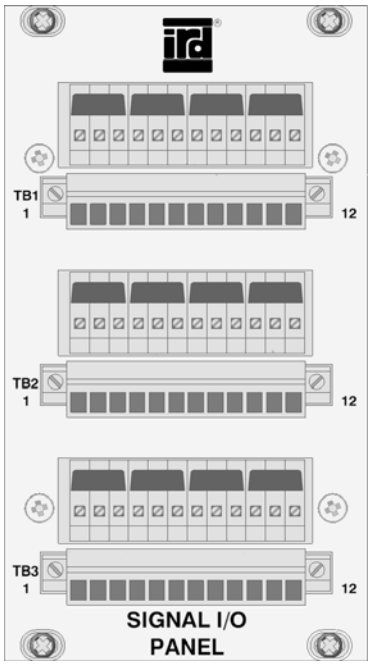


Figure 18 – Signal I/O panel

On the back of each Signal I/O panel are two 24 pin ribbon cable connectors, one for signals to and from a Loop Sensing Module and one for all other signals. If an I/O panel is handling the signals for an LSM, the ribbon cable must be attached to the lower connector. If the panel is handling signals for any other type of module, the cable must be attached to the upper connector.

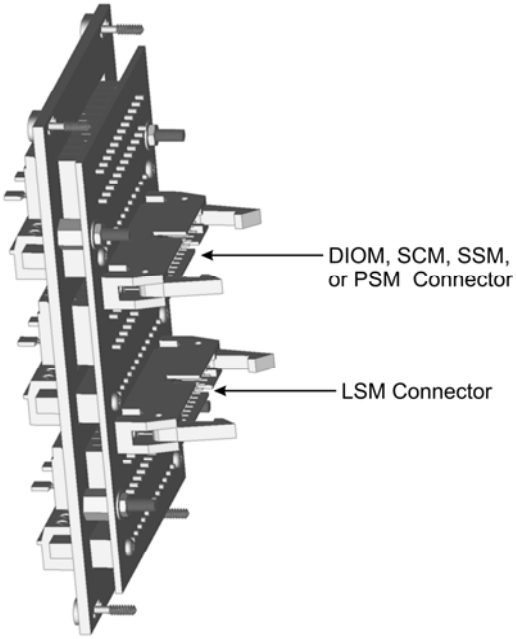


Figure 19 - Back of Signal I/O Panel

The Signal I/O panel also houses primary over-voltage protection. Each I/O line is protected by a solid state over-voltage protection device (refer to Appendix D for specifications). Each over-voltage device protects the I/O line located immediately below it on the Signal panel.

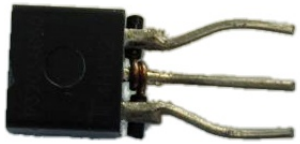


Figure 20 – Over-voltage Protection Device

The over-voltage device will protect the iSINC circuitry by automatically switching the line closed when a transient spike occurs. For very powerful transients, the device acts as a fuse and will short to ground; in this case, the device will be sacrificed to save the downstream electronics and it will be necessary to replace the over-voltage protector. If the iSINC indicator lights show that a signal is not being received, check the over-voltage protection for that component. The screw clamps below each pin of the over-voltage protectors also serve as a test points; use an ohmmeter to check for a short to ground between the signal lines and the center ground line.
The Signal I/O panels are assigned specific locations in the mounting rack, which correspond to the modules in the iSINC chassis to which they are connected. If a module is not present in the iSINC chassis, then that Signal I/O panel position will have a blank panel installed. Refer to Appendix A.1.4 for descriptions of the various system layout options.
If the system uses Dynax axle and/or off-scale sensors, these will interface through a unique Signal I/O panel. The Dynax signal input panel houses signal conditioning hardware behind the panel:

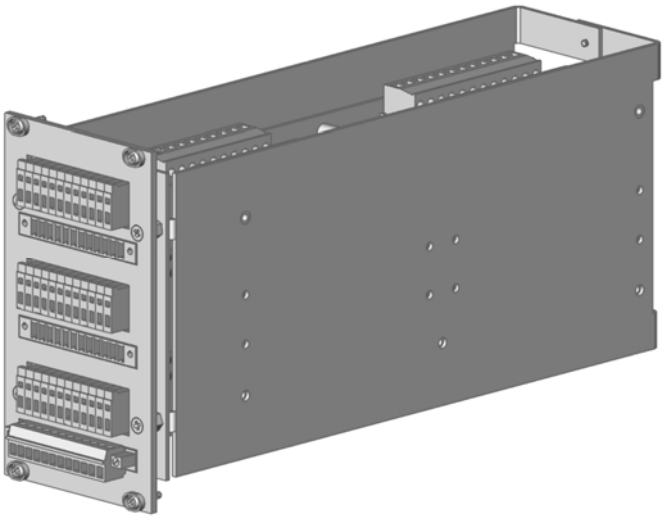


Figure 21 - Dynax Signal Input panel

Refer to Appendix A.1.2.1 for the terminal block connector number assignments for the Dynax input signal wiring.

4.3.6 Ethernet

If the system is to be connected to an Ethernet network, the connection is made via the 10/100-TX Ethernet connector on the front panel of the WCU. Refer to section 4.3.10.4 for information on establishing a network connection.

4.3.6.1 Modem

An optional modem provides a dial-up connection for remote system administration such as downloading data, operational checks and resetting weight limits.

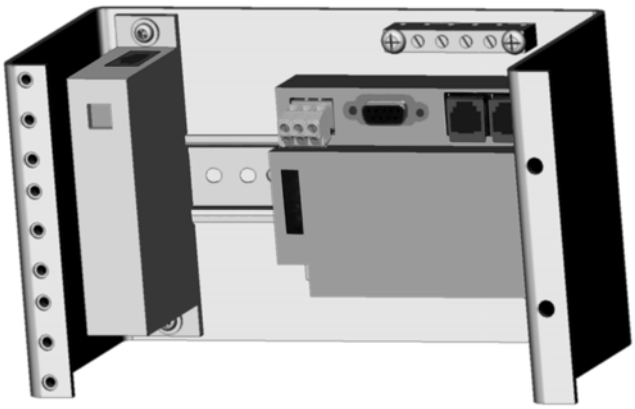


Figure 22 - Modem panel

The modem connects to the WCU through a serial cable to the port labeled **COM** on the WCU
Transient over-voltage protection on the telephone line is provided by a Zone Barrier surge protector.
Refer to section 4.3.10.4 for information on establishing a remote phone line connection.

4.3.7 Power Panel

4.3.7.1 AC Power panel

The panel for utility supplied AC power is accessed through the rear door of the electronics cabinet and is located on the left side of the rack (when viewed from the rear). The panel contains:

Main Circuit breaker box with a 30 Amp, 2 pole breaker

Sub-circuits breaker box with 4 x 15 Amp, single pole breakers

12 Volt power supply for iSINC electronics

Three duplex outlets

One Ground Fault Interrupt duplex outlet

Over-voltage protection

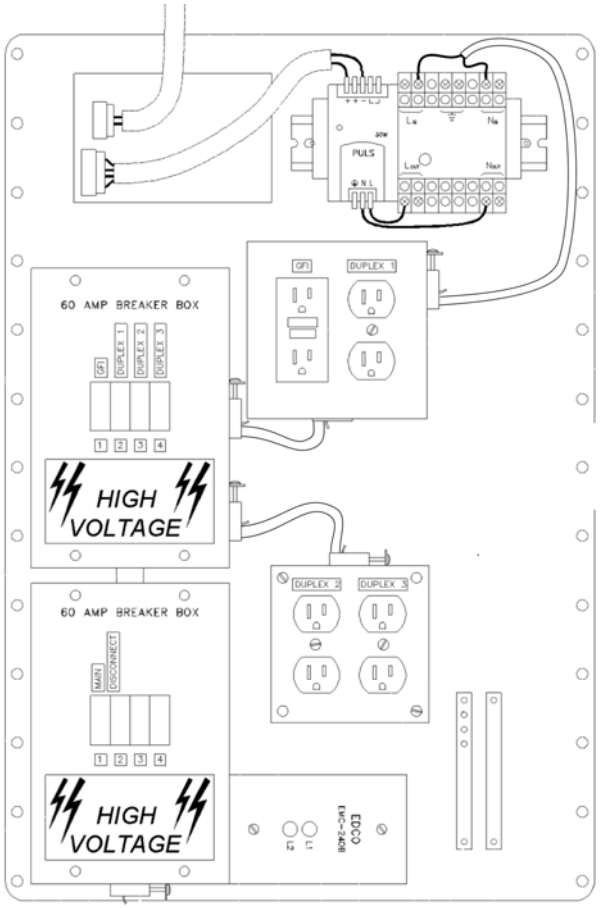


Figure 23 - AC Utility power panel

The AC main input is a 240 Volt utility supply. This is divided into two 120 volt circuits in the Main (lower) circuit breaker box which then feed up to the Service circuit breaker box. In the Service box the supply is divided into four 15 Amp circuits:

Circuit 1 – the GFI outlet

Circuit 2 – the iSINC power supply and Duplex outlet 2

Circuit 3 – Duplex 3

Circuit 4 – Duplex 4

The incoming line is connected to a primary over-voltage surge protection device attached to the Main breaker box. There are two indicator lights on the over-voltage protection box, labeled **L1** and **L2** for the two 120 volt circuits. Under normal operating conditions these lights will be on. If the power is off or the over-voltage device has been overloaded, the light for that circuit will be off.

4.3.7.2 Solar Panels & Battery Supply

The system may be equipped with an optional battery back-up power supply. The battery charging system may be from the main AC power supply or from an optional solar panel.
The length of time that the back up battery will provide power to keep the system operational will depend on the number and type of sensors in the system; the minimum operation time will be 10 hours at a very large, high traffic volume installation, a more typical installation would operate for approximately 48 hours without external power.

4.3.8 Sensors

The set of sensors in a traffic lane used to measure a vehicle's speed, dimensions and weights is know as a sensor array. The array may include any of the following sensors:

4.3.8.1 Single Load Cell Scales

Single Load Cell (SLC) Weigh-In-Motion scales determine axle weights using a hydraulically activated load cell mounted in the center of a scale pad. Typically two SLC scales placed side by side across the lane will be used in an array and can measure the weight of each side of an axle separately.

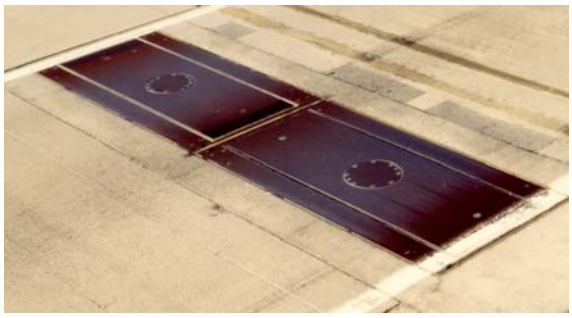


Figure 24 – Single Load Cell scales

4.3.8.2 Bending Plate Scales

Bending plate Weigh-In-Motion scales determine axle weights using strain gauges to measure the deflection of a steel pad. Typically two bending plate scales placed side by side across the lane will be used in an array and can measure the weight of each side of an axle separately.

Figure 25 - Bending Plate scales

4.3.8.3 Piezo Class I Scales

Piezo Class I and Kistler Quartz Lineas Weigh-In-Motion scales generate a piezoelectric current that is proportional to the vehicle's weight from the deformation of a crystal embedded in the sensor.

Figure 26 - Piezo Class I sensor

4.3.8.4 Inductive Loop Sensors

Sensing loops produce a current by magnetic induction when a vehicle passes over them. They are used to determine the vehicle's length and speed.

Figure 27 - Loop sensors

4.3.8.5 Piezo Class II Axle Sensors

The Piezo Class II axle sensors generate a piezoelectric current from the deformation of a crystal embedded in the sensor. They are used to accurately determine axle spacing for vehicle classification and bridge formula calculations.

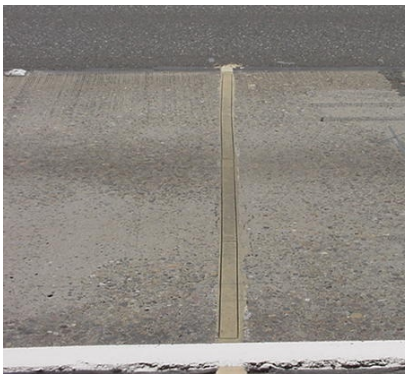


Figure 28 - Piezo Class II sensor

4.3.8.6 Dynax Axle Sensors

The Dynax axle sensors change resistance when pressure is applied on them. They are used to accurately determine axle spacing for vehicle classification and bridge formula calculations.
Dynax sensors may also be used at the outside edges of the WIM scales to act as off- scale detectors

Figure 29 - Dynax sensor

4.3.9 iSINC Data Collection System

4.3.9.1 Operation

IRD iSINC Data Collection Systems weigh and identify vehicles and store the resulting data records for use in analyzing traffic flows and/or the durability of roadways.

Weigh-In-Motion (WIM) technology uses sensors and/or scales imbedded in the road surface to collect data on passing traffic. This data includes measurements on vehicle spacing, speed, axle counts as well as axle and gross vehicle weight. The weight data collected is dependent on several factors, the most important of which is vehicle dynamics.

4.3.9.2 Factors Affecting WIM Operation

The WIM system measures the actual forces applied to the scale, which include forces caused by vehicle dynamics. Vehicle dynamics is the term used to describe the bouncing, load shifting, lateral sway, etc which occurs when a vehicle is in motion. A truck which is bouncing on a scale can cause an inaccurate reading (just as the weight reading on a static scale changes while a vehicle is moving on the platforms). To standardize the performance requirements of WIM systems, specifications for the smoothness and slope of roads used in WIM applications have been developed (refer to ASTM E1318-02 Standard Specification for Highway Weigh-in-Motion (WIM) Systems).

Where a high level of accuracy is required (WIM sorting at a weigh station), stringent controls on road quality and a high performance WIM system must be employed. These are to ensure that the road is smooth up and downstream of the scale and that the road is relatively flat. By reducing the impact on the vehicles the loads are more stable and the WIM system is more accurate.

Although these specifications reduce the effect of dynamics, vibration, etc, they cannot be completely avoided. This is especially true when a vehicle is hauling liquid loads (fuel tankers, etc). Due to the variable nature of these types of loads, they are not considered when determining a WIM system's accuracy. Additionally, since the dynamics cannot be completely removed by the above controls, the accuracy requirements for WIM systems allow for error and use statistics to determine the actual performance.

4.3.10 System Software Operation

The software program that controls iSINC operations runs on the WCU. The program runs from the WCU memory. A copy of the current system configuration is stored on the flash card; if no flash card is present, the default settings are used; if any changes to system settings are made, they must be saved to the flash card if they are to be used for future system operations (refer to section 4.3.11).
The iSINC program is menu driven. A complete layout of the menu tree is displayed in Appendix E.
The menus are accessed through a terminal connection.

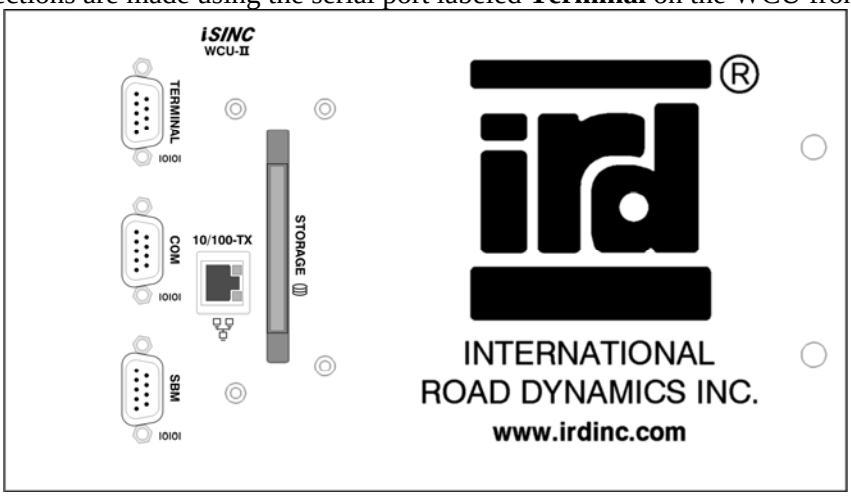
4.3.10.1 Terminal Connection

There are three options for making a terminal connection to the iSINC controller:

Through a PC (Personal Computer) set to terminal mode
Through a terminal keypad
Via a *secure shell* remote connection

4.3.10.2 Local terminal Emulation on a PC

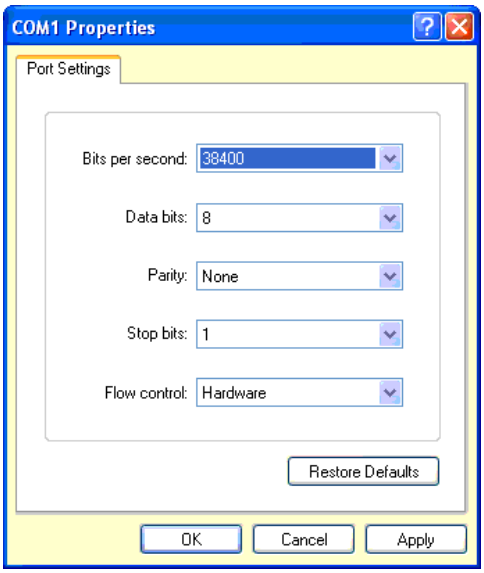
Local terminal connections are made using the serial port labeled **Terminal** on the WCU front panel:



To connect to the iSINC directly a Personal Computer acting as a terminal:

- Using an RS232 null modem cable, connect the serial COM port on the PC to the iSINC serial port labeled **Terminal**.
- Start a terminal emulation program such as MS Windows Hyper Terminal.
- Skip (click on the Cancel button) past any requests for telephone connection information.
- Select the computer COM port that the PC end of the cable is plugged into:

- Enter the following port settings:
  connection speed – **38400** Bits per second
  data bits – **8**
  parity – **None**
  stop bits – **1**
  control – **Hardware**



- The terminal screen will appear, Press the left arrow key < ← >, the iSINC will reply with the login screen; proceed to section 4.3.10.5 for log in instructions.

4.3.10.3 Keypad Terminal

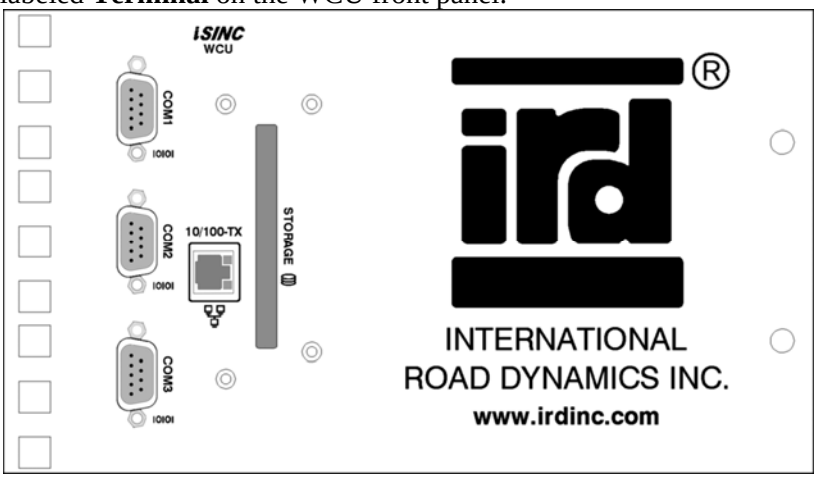
To connect the iSINC with a keypad terminal:

- Connect a straight RS232 cable between the female connector on the front panel of the iSINC serial port labeled **Terminal** and the keypad terminal.
- Press the left arrow key (◁) , the iSINC will reply with the login screen, proceed to section 4.3.10.5 for log in instructions.

Figure 30 - Keypad terminal

4.3.10.4 Remote (Network) Connection

The iSINC can establish a network connection over either a 10/100Base-T Ethernet cable, or through a telecom link to the modem. The 10/100 Ethernet connection is through a standard RJ45 Ethernet cable plugged into the socket labeled **10/100TX** on the iSINC front panel. The modem connection is through a 9 pin RS232 cable plugged into the port labeled **Terminal** on the WCU front panel.



> **Note**: a remote connection cannot be established if a local terminal is logged in. It is important that the local terminal be logged out when a session is finished if there is a remote link to the iSINC, otherwise no remote connection can be made.

To log in over a LAN/WAN network using a secure shell client, connect to the iSINC using the IP address provided by the system installer or, if none has been assigned, the default address of 127.0.0.1

The terminal screen will appear. Press the <***Enter***> key, the iSINC will reply with the login screen: proceed to section 4.3.10.5 for log in instructions.

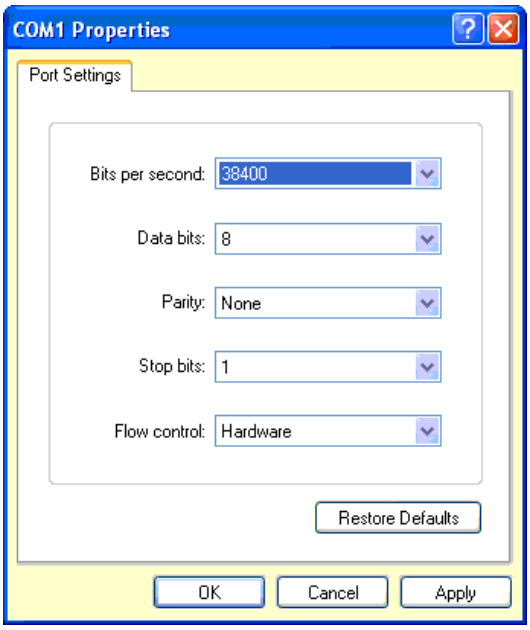
> The IP address and mask of the iSINC can be reset to match the LAN/WAN network configuration. Refer to section 4.3.11.12.

To connect over a dial-up telephone link using a modem:

- Start a terminal emulation program such as MS Windows Hyper Terminal.

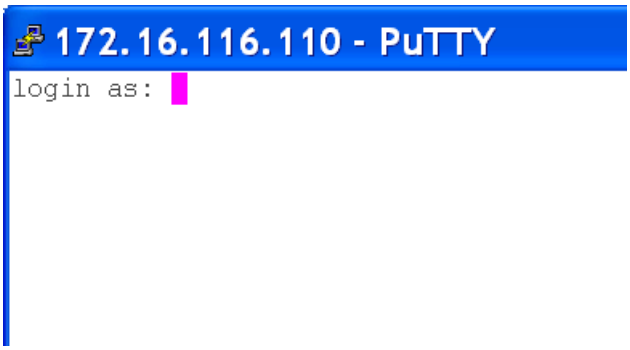
- Enter the for telephone connection information (country, area code and telephone number assigned to the iSINC modem).
- Select the computer COM port the modem is plugged into.

- Enter the following port settings:
  connection speed – **38400** Bits per second
  data bits – **8**
  parity – **None**
  stop bits – **1**
  control – **Hardware**



- Press the <***Enter***> key, the iSINC will reply with the login screen; proceed to section 4.3.10.5 for log in instructions.

4.3.10.5 Login

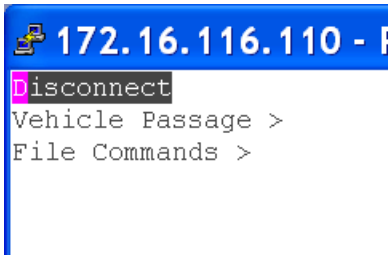


The Login screen will prompt for a name or number. There are four valid user name/numbers available: **4**, **3**, **user,** and **admin**. Login numbers are used because the keypad has only numbered keys; the login number “4” is equivalent to the login name “user” and the login number “3” is the same as the login name “admin”. The login name/number entered determines what menu options are displayed; “4” and “user” will see only vehicle record display options, “3” and “admin” will be shown the system configuration menus in addition to the “user” menu options.

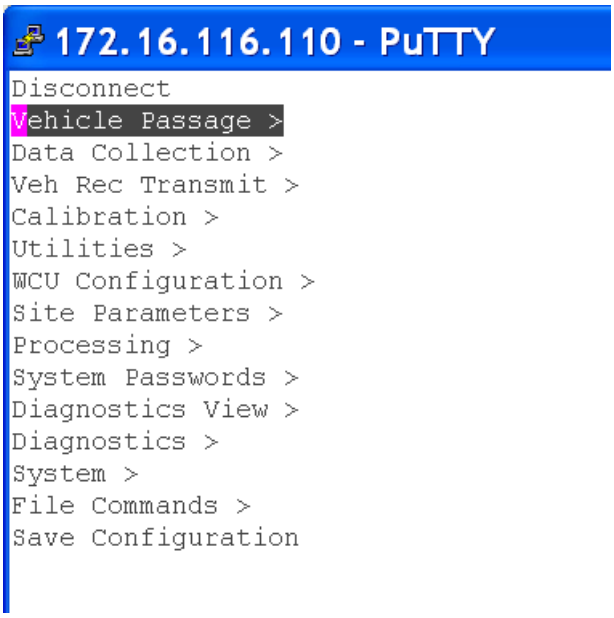
Once a name or number is entered, the system will prompt for a password; key in the password that corresponds to the name/number, then press the <***Enter***> key. The default password for “user” is <**user**>, the default password for “admin” is <**admin**>, the default password for “4” is <**4**>, the default password for “3” is <**3**>. The password for admin level users (login “admin” or “3”) may be changed in the **System Passwords Menu**, section 4.3.11.17.

4.3.11 Main Menu

Once the password has been successfully entered, the main menu will be displayed. The menu options that appear on the screen will depend on the login.
"user" or "4" will see:



"admin" or "3" will see:

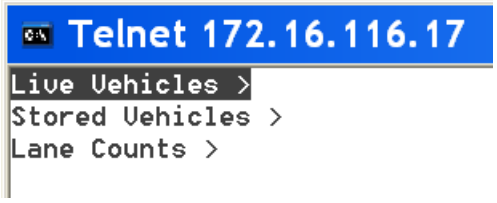


In the sections that follow, menu options available only to admin level login will have an asterisk (*****) following the menu label (as in the "Save Configuration" option below).
All but two of the options on the main menu open sub-menus:

- **Disconnect** – closes the menus and ends the session.
- **Save Configuration *** – Saves the system configuration settings to the flash card. If any changes to the system settings have been made, they must be saved using this selection before they will take effect. If the session is closed without doing a "**Save Configuration**", all changes will be lost.

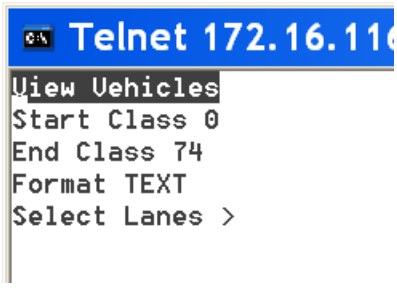
4.3.11.1 Vehicle passage

The **Vehicle Passage** menu lists three sub-menu options to display vehicle data on the terminal:



Live Vehicles

The **Live Vehicles** menu sets options to display vehicle records in real time as the vehicles pass through the selected sensor arrays.



- **View Vehicles** – starts the displaying of vehicle records. To pause the display, press the <***Space***> bar; the stop the display and return to the menu, press the left arrow ← key.
- **Start Class** – the lowest class number of vehicle to display (refer to Appendix A.1.7 for an example of a vehicle classification system)
- **End Class** – the highest class number of vehicle to display. All vehicle classes between the Start and End class will be displayed.
- **Format** – The vehicle record may be displayed in one of two formats:

  A.1 Text – which lists the axle separations and weights in a table similar to the following illustration:

```
=====================================================================

(3452) LANE   CLASS 0  GVW 27.2 kips LENGTH 49 ft PASS
SPEED 8.9mph  MAX GVW 70.0 kips Wed Jul 28 2004 14:47:15 (3550)
AXLE    SEPARATION     TOTAL WT    ALLOWABLE
          (in)         (lb)         (lb)
 1                      5413         7000
 2         130          5413        13000
 3          47          5446        13000
 4         276          5468        13000
 5          59          5490        13000

=====================================================================
```

or

- **Graphic** – which shows a graphic representation of the axle separations and weights in a diagram similar to the following illustration:

```
==========================================================================

 (3452) LANE   CLASS 0  GVW 27.2 kips LENGTH 49 ft PASS
 SPEED 8.9mph  MAX GVW 70.0 kips Wed Jul 28 2004 14:47:15 (3550)
  |<---------- 42.7ft ---------->|
  o    o             o    o      o
 5.5  5.5           5.4  5.4    5.4


==========================================================================
```

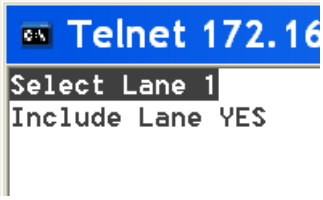
Each vehicle's information record includes:

- **Sequence number** (3452 for the example above). Numbers are sequentially assigned to vehicles in the order they enter the system. Sequence numbers count up to up to 65,000 and then start over at 1.
- **LANE** (blank for the example above). Used in systems with more than one scale to show which scale this record came from.
- **CLASS** (0 for the example above). If the classification mode is **FULL**, this shows the bridge compliance formula class assigned to this vehicle. If the classification mode is **BASIC**, class will be shown as 0.
- **GVW** (46.3 kips for the example above). The gross vehicle weight as calculated by the WIM system.
- **LENGTH** (49 ft for the example above). The total length of the vehicle.
- **TOTAL AXLE SPAN** (not shown in the example above). If the system does not have inductive sensing loops, the distance from the front to the rearmost axle is displayed.
- **PASS/FAIL** (Pass for the example above). This indicates whether or not the vehicle has failed to meet one or more of the compliance settings.
- **SPEED** (8.9 mph for the example above).
- **MAX GVW** (80.0 kips for the example above). In **FULL** compliance mode, the iSINC calculates the bridge formula compliance classification for the vehicle and looks up maximum gross vehicle weight allowed for that class. In **BASIC** compliance mode, the max GVW is set in the Basic compliance table.
- **Date and Time** (Wed Jul 28 2004 14:47:15 for the example above). The day, date and time of day (from the system clock) when the information was recorded. Time is displayed in 24-hour notation.
- **Ticks** (3550 for the example above). The time the vehicle took to pass through the system, measured as a count of .25 millisecond ticks.
- In **Text** display format, a table listing each axle, its separation from the preceding axle, its weight and the allowable maximum weight is displayed.
- In **Graphic** display format, a diagram of the axle spacings and the weight on each axle is displayed. The number between two arrows **|<-----42.7---->|** is the spacing between the front and rear axles; axles are indicated with an open circle **O**, the number below each axle is its weight.

A vehicle with an error in the record (for example vehicle too fast), will display only an error message with no vehicle data.

4.3.11.2 Select Lanes

The **Select Lanes** menu controls which lanes will display vehicle records to the terminal and which do not.

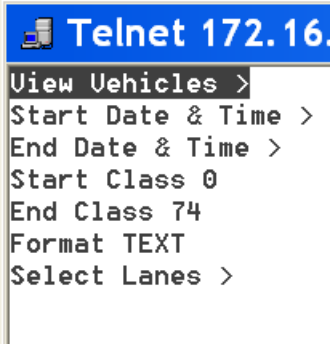


Select lane, press the <***Enter***> key, key in the lane number (between 1 and 8) to be changed, press the <***Enter***> key.

Include Lane, press the <***Tab***> key to toggle the selection between **Y** and **N**, press the <***Enter***> key. Repeat the selection for each lane to be displayed (up to 8 lanes).

Stored Vehicles

The **Stored Vehicles** menu displays vehicle records selected from the data file stored on the iSINC flash card.



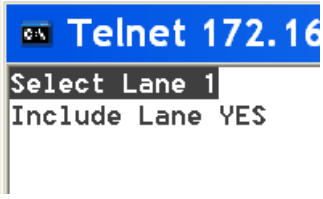
- **Format** – The vehicle record may be displayed in one of two formats:
  - **Text** – which lists the axle separations and weights in a table
  - **Graphic** – which shows a graphic representation of the axle separations and weights in a diagram

Refer to the previous menu (0 - Live Vehicles) for a detailed description of the record displays.
Vehicle records may be filtered based on date & time, class, and lane number:

- **Start Class** – the lowest class number of vehicle to display (refer to appendix A.1.7 for an example of a vehicle classification system)
- **End Class** – the highest class number of vehicle to display. All vehicle classes between the Start and End class will be displayed.
- **Start Date & Time** – The default date and time are those of the oldest record. To change the date and time, highlight the bottom line of the display, then press the <***Enter***> key. Key in the new date and time settings in exactly the same format as displayed in the line above the entry (**DD/MM/YYYY HH:MM:SS**). Hours must be in 24 hour clock notation. Press the <***Enter***> key to activate the new settings.
- **End Date & Time** – The default date and time are those of the most recent record. To change the date and time, highlight the bottom line of the menu display, then press the <***Enter***> key. Key in the new date and time settings in exactly the same format as displayed in the line above the entry (**DD/MM/YYYY HH:MM:SS**). Hours must be in 24 hour clock notation. Press the <***Enter***> key to activate the new settings.

Select Lanes

The **Select Lanes** menu controls which lanes will display vehicle records to the terminal and which do not.



- **Select lane**, press the <***Enter***> key, key in the lane number (between 1 and 8) to be changed, press the <***Enter***> key.
- **Include Lane**, press the <***Tab***> key to toggle the selection between **Y** and **N**, press the <***Enter***> key.

Repeat the selection for each lane to be displayed (up to 8 lanes).

View Vehicles

Starts the displaying of vehicle records. Records are displayed in chronological order, starting from the oldest record.

To pause the display, press the <***Space***> bar; the stop the display and return to the menu, press the left arrow ← key.

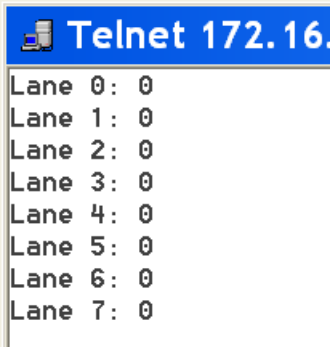
There are two options for record display:

- **One at a Tim**e – displays one complete record and then pauses, press the <***Space***> bar to display the next record.
- **Non Stop** – all the records in the file will be displayed. If the listing fills more than one screen, the up and down arrows can be used to scroll the visible portion of the list up and down on the screen.

4.3.11.3 Lane Counts

The **Lane Count** menu displays a count of the number of vehicles for the selected lanes and classes since the counter was last reset

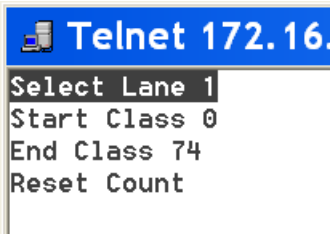
- **View Counts** – displays the vehicle count:



- **Reset All Counts *** – resets the vehicle counters for all lanes to zero.

Set Lane Filters

The **Set Lane Filters** menu sets which classes will be included in the count for a specified lane. The counter for that lane may also be reset.

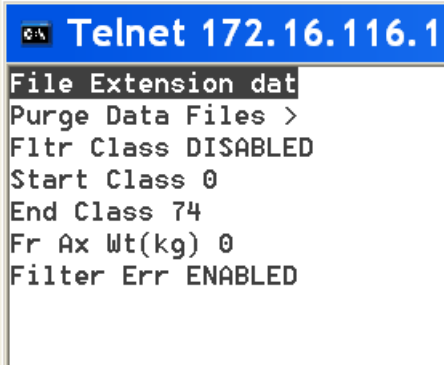


- **Select Lane** – enter the lane number on which to set the class filter.
- **Start Class** – the lowest class number of vehicle include in the lane count.
- **End Class** – the highest class number of vehicle to include in the lane count.

- **Reset Count** – resets the vehicle counter for the specified lane to zero.

4.3.11.4 Data Collection *

The **Data Collection** menu sets the parameters for storing vehicle records on the iSINC flash card.



- **File Extension** * – data collection sites are identified by their three character file extension. Enter the unique 3 character code for this site.
- **Fltr Class *** – enables or disables data filtering based on vehicle class.
- **Start Class *** – the lowest class number of vehicle record to include in the database.
- **End Class *** – the highest class number of vehicle to include in the database.
- **Fr Ax Wt *** – the minimum front axle weight, below which the vehicle record will not be saved (the vehicle will still be added to the vehicle count data).
- **Filter Err *** – enables or disables saving vehicle records in which the error flag has been set

4.3.11.5 Purge Data Files *

The **Purge Data Files** menu deletes all records on the system flash card that were recorded prior to the specified date and time.

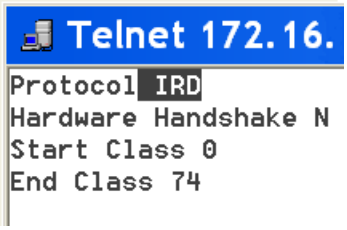
- **Purge *** – highlight this option and press the <***Enter***> key to perform the deletion. An "**Are you sure?**" confirmation message will be displayed. Press the "**Y**" to complete the deletion, press the "**N**" key to cancel and return to the menu.
- **End Date & Time *** – the end of the deletion period; all records prior to this date and time will be deleted. The default date and time are those of the most recent record. To change the date and time, highlight the bottom line of the menu display, then press the <***Enter***> key. Key in the new date and time settings in exactly the same format as displayed in the line above the entry (**DD/MM/YYYY HH:MM:SS**). Hours must be in 24 hour clock notation. Press the <***Enter***> key to activate the new settings.

4.3.11.6 Vehicle Record Transmit *

The **Vehicle Record Transmit** menu sets the parameters used to transmit vehicle records when it receives a request form the WCU COM port or from the SBM in the iSINC chassis.

WIM Bus * – toggles whether or not vehicle records will be transmitted over the iSINC CAN Bus (to the SBM).

4.3.11.7 Serial Port *



- **Protocol *** - There are four options for the protocol used for vehicle record transmission: **None, IRD**, **HELP** or **HELP NO WEIGHT** transfer protocol. These protocols are defined as follows:

  A.2 None – data is not transmitted. Selecting this option turns the function off.

A.3 IRD Transfer Protocol (Non-Error Vehicle)

Bytes	Content	Description	Format
1	STX	Start of Text	C
3	NNN	Message Length in bytes	NNN
1	Message Code	Code Representing the Message Type: 'V' – Vehicle Data	C
1	0x30	Format Code, always 0x30	X
6	Vehicle number	6 digit vehicle sequence number	NNNNNN
2	Lane number	lane number, 1 digit signed number (1-99)	NN
4	Year	Year (0000-9999)	CCYY
2	Month	Calendar Month (01-12)	MM
2	Day	Day of Month (01-31)	DD
2	Hour	GMT hh format (00-23)	HH
2	Minute	GMT mm format (00-59)	MM
2	Seconds	Seconds past the minute (00-59)	SS
2	Hundredths	Hundredths of a minute (00-99)	TT
2	Number External Data Items	The number of external data items attached to the vehicle record	NN
2	Length of String	The length of the 1st external data item string	NN
X	External Data Item Data	The character data in the 1st external item data field	CCC…C
..	..	Repeat preceding 2 rows for every external data item	..
2	Error Code	The error code variable of the vehicle record.	NN
3	Temperature	The road temperature	NNN
2	Record Type	The type of vehicle record	NN
3	Speed	The speed of the vehicle in km/h.	NNN
4	Vehicle Length	The length of the vehicle in cm	NNNN
3	Front Axle Space	The distance between the front axle and the front bumper in cm.	NNN
2	Number of Axles	The number of axles on the vehicle.	NNN
4	Inter-Axle Space	The axle space between the 1st and 2nd axles in cm.	NNNN
..	..	Repeat above row for every inter-axle space	
5	Axle Weight	The axle weight of the 1st axle in kg	NNNNN
..	..	Repeat above row for every axle weight	
1	ETX	End of Text	C
4	Checksum	CRC16 Checksum	XXXX
1	EOT	End of Transmission	

Table 1 - IRD Protocol (Non-error Vehicle)

A.4 IRD Transfer Protocol (Error Vehicle)

# of Bytes	Content	Description	Format
1	STX	Start of Text	C
3	NNN	Message Length in bytes	NNN
1	Message Code	Code Representing the Message Type: 'V' – Vehicle Data	C
1	0x30	Format Code	X
6	Vehicle number	6 digit vehicle sequence number	NNNNNN
2	Lane number	lane number, 1 digit signed number (1-99)	NN
4	Year	Year (0000-9999)	CCYY
2	Month	Calendar Month (01-12)	MM
2	Day	Day of Month (01-31)	DD
2	Hour	GMT hh format (00-23)	HH
2	Minute	GMT mm format (00-59)	MM
2	Seconds	Seconds past the minute (00-59)	SS
2	Hundredths	Hundredths of a minute (00-99)	TT
2	Number External Data Items	The number of external data items attached to the vehicle record	NN
2	Length of String	The length of the 1st external data item string	NN
X	External Data Item Data	The character data in the 1st external item data field	
..	..	Repeat preceding 2 rows for every external data item	..
2	Error Code	The error code variable of the vehicle record.	NN
3	Temperature	The road temperature	NNN
1	ETX	End of Text	C
4	Checksum	CRC16 Checksum	XXXX
1	EOT	End of Transmission	

Table 2- IRD Protocol (Error Vehicle)

A.5 HELP Transfer Protocol

# of Bytes	Content	Description	Format
1	SOH	Start of Header	C
1	Message content	Message ID 0 – WIM 1 – Remote Console 2 – WIM2 3 – Sort Decision Override	C
1	STX	Start of Text	C
1	<	Start of the vehicle record	C
1	L=lane	lane number, 1 digit signed number (1-8)	N
1	Ld=lane direction		N
2	Mo=month	Calendar Month (01-12)	MM
2	DD=day	Day of Month (01-31)	DD
2	YY=year	Year (00-99)	YY
2	HH=hour	Hour format (00-23)	HH
2	MM=minutes	Minute format (00-59)	MM
2	SS=seconds	Seconds past the minute (00-59)	SS
2	HS=hundredths of sec	Hundredths of a minute (00-99)	TT
6	Vehnum=vehicle num	5 digit vehicle sequence number (1-65000)	NNNNN
2	NA=number of axles	Number of Axles (0-99)	NN
2	CL=class	Vehicle Classification (0 -13)	NN
4	GROS=gross weight /100	Gross Vehicle Weight (0 -9999)lbs / 100	NNNN
4	LENG=overall length *10	(bumper to bumper) (0 -9999) ft*10	NNNN
4	SPED=speed *10	MPH *10	NNNN
3	SP1=axle spacing 12*10	Axle spacings (0-1400) ft*10	NNN
3	SP2=axle spacing 23*10	Axle spacings (0-1400) ft*10	NNN
3	SP3=axle spacing 34*10	Axle spacings (0-1400) ft*10	NNN
3	SP4=axle spacing 45*10	Axle spacings (0-1400) ft*10	NNN
3	SP5=axle spacing 56*10	Axle spacings (0-1400) ft*10	NNN
3	SP6=axle spacing 67*10	Axle spacings (0-1400) ft*10	NNN
3	SP7=axle spacing 78*10	Axle spacings (0-1400) ft*10.	NNN
3	SP8=axle spacing 89*10	Axle spacings (0-1400) ft*10	NNN
3	WT1=weight of axle 1/100	Axle weight (0- 999)lbs / 100	NNN
3	WT2=weight of axle 2/100	Axle weight (0- 999)lbs / 100	NNN
3	WT3=weight of axle 3/100	Axle weight (0- 999)lbs / 100	NNN
3	WT4=weight of axle 4/100	Axle weight (0- 999)lbs / 100	NNN
3	WT5=weight of axle 5/100	Axle weight (0- 999)lbs / 100	NNN

3	WT6=weight of axle 6/100	Axle weight (0- 999)lbs / 100	NNN
3	WT7=weight of axle 7/100	Axle weight (0- 999)lbs / 100	NNN
3	WT8=weight of axle 8/100	Axle weight (0- 999)lbs / 100	NNN
3	WT9=weight of axle 9/100	Axle weight (0- 999)lbs / 100	NNN
1	>	End of vehicle record	C
1	ETX	End of text	C
1	LRC	Calculated by XORing from SOH to ETX inclusively. Transmit the MSB first.	XX
1	EOT	End of Transmission	C

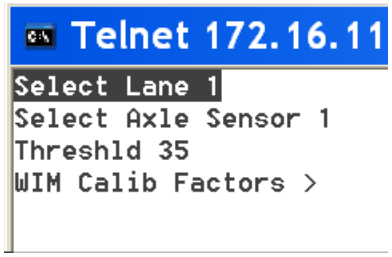
Table 3 - HELP Protocol

A.6 HELP NO WEIGHT Transfer Protocol - Identical to **HELP** format except that the weights, length, axle spacings and speed are filled in with values of zero.

- **Hardware Handshake** – toggles use of hardware handshake on or off
- **Start Class** – the lowest class number for a vehicle record to be transmitted.
- **End Class** – the highest class number for a vehicle to be transmitted; all records with a classification between the Start Class and End class will be transmitted.

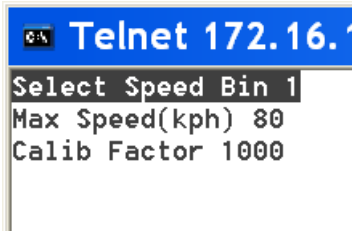
4.3.11.8 Calibration *

The **Calibration** menu options set the weigh-in-motion axle sensor parameters. Each WIM sensor will require periodic tuning to adjust for changes in the road surface and the scale hardware.



- **Select Lane *** – the lane number in which the WIM sensor is located
- **Select Axle Sensor *** – the WIM axle sensor number (between 1 and 4)
- **Threshold *** – There is typically has some noise in the signal from an axle sensor. The threshold value minimizes the effect of the noise by setting the level above which a signal will be considered an axle, and below which it will be considered noise. The threshold value should be set high enough to filter noise but low enough to detect all axle signals. If the threshold is set too high the system will miss axles and if the threshold is set too low the system will falsely register some electronic noise as axles.

4.3.11.9 WIM Calibration Factors *



The accuracy of WIM measurements may be affected to some degree by vehicle speed. In order to increase accuracy, a different WIM calibration factor may be assigned for up to five different speed groupings (bins). The range of a speed bin is from the max speed of the previous bin to the max speed of the bin being configured (bin 1 has a minimum speed of 1).

- **Select Speed Bin *** – the number of the speed bin being configured (from 1 to 5).
- **Max Speed *** – the maximum speed for this speed bin
- **Calib Factor *** – the WIM sensor calibration factor for this speed bin. The default calibration factor is: 1000 To adjust the calibration factor using a vehicle of a known measured weight and speed, calculate a new calibration factor as follows:

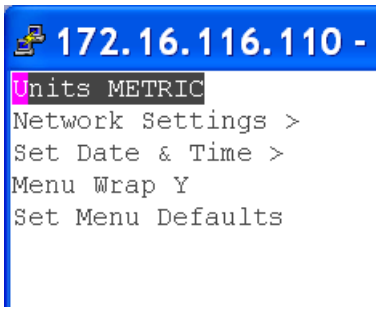
New Calib. Factor = Current Calib. Factor * Actual Weight / Displayed Weight

Repeat for each speed bin (up to a maximum of five) used with this WIM sensor.

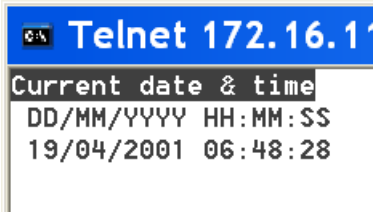
Repeat the calibration for each axle sensor and each lane.

4.3.11.10 Utilities Menu *

The **Utilities** menu sets various system parameters.



- **Units *** – the measuring units currently in use are displayed. Selection options are: Metric, US-Lbs&Ins, and US-KIPs&Ft.
  Note that this setting only effects what is displayed on the terminal, all data is saved in metric units regardless of this setting.
- **Time & Date *** – this sub-menu displays the current time and date and resets the date and time:

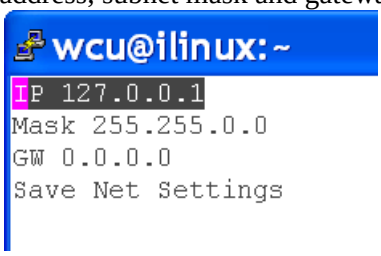


  To change the date and time, highlight the bottom line of the menu (the date and time display) then press the <***Enter***> key. Key in the new date and time settings in exactly the same format as displayed in the line above the entry (***DD/MM/YYYY HH:MM:SS***). Hours must be in 24 hour clock notation. Press the <***Enter***> key to activate the new settings.
- **Menu Wrap *** – toggles menu navigation wrap (menu selection jumps back to the top of the menu when scrolled off the bottom or jumps to the bottom when scrolled off the top) on and off. To change the wrap mode, toggle the selection between **Y** (yes) and **N** (no).
- **Set Menu Defaults *** – resets all menu settings back to the factory defaults. To reset the settings, highlight Set Menu Defaults then press the <***Enter***> key. An "**Are you sure**" confirmation message

will appear, press the <***Enter***> key again to confirm the reset or use the left arrow ← key to return without resetting.

4.3.11.11 Network Settings *

The **Network Settings** menu sets the IP address, subnet mask and gateway used by the iSINC.



- **IP *** – displays the current IP address of the iSINC controller. Key in the IP address for the iSINC.
  Note: *this option is not required if the system will not be connected to a network.*
- **Mask *** – displays the current IP address mask. Key in the IP address mask.
  Note: *this option is not required if the system will not be connected to a network.*
- **GW *** – displays the current address of the network Gateway. Key in the Gateway address.
  Note: *this option is not required if the system will not be connected to a network..*
- **Save Net Settings *** – saves and enables any changes made; if this menu option is not used, any changes made will be discarded after leaving this menu.

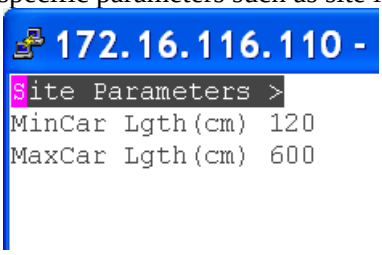
4.3.11.12 WCU Config *

The **WCU Config** menu sets the screen sleep time.

- **Scrn Sleep *** – the length of time the terminal can be inactive before the iSINC will automatically log the user out. Typically set to 10 minutes (the maximum).

4.3.11.13 Site Parameters *

The **Site Parameters** menu sets the site specific parameters such as site identity and system sensor configuration.



Minimum Car Length * and **Maximum Car Length ***- if no axle sensor data is available but a vehicle is detected by the sensing loops, the system will attempt to determine if the vehicle was a car and if it was, repair the record so that it may be used for traffic statistics. The method of determining if the vehicle was a car is to compare the calculated length to the minimum and maximum limits set with these options. If the length is within these limits, the vehicle record has the following data inserted:

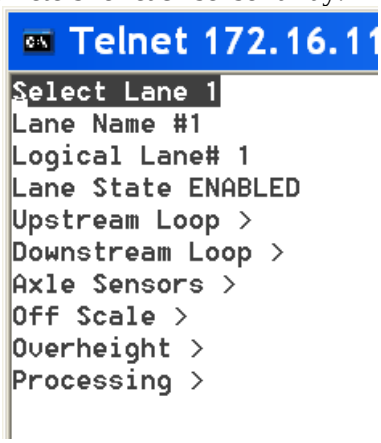
- Number of axles: 2

- Wheelbase: vehicle length minus 60 cm (2 feet)
- Weight: 333 kg per axle (gvw 666 kg,, 1465 pounds)

If the vehicle is outside these limits, the record is flagged as an error record.

4.3.11.14 Site Parameters Sub-menu *

The **Site Parameters** sub-menu sets parameters for each sensor array:

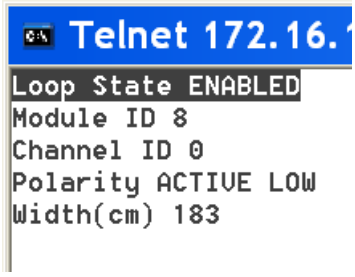


- **Select Lane *** – the lane number in which the sensor array is located. One WCU can process the signals from up to eight lanes of sensors. The lane number is the primary identifier of the sensor array in the iSINC system.
- **Lane Name *** – the lane may be assigned a name of up to 9 characters.
- **Logical Lane# *** –if there are more than eight lanes at this site, multiple WCUs will be present in the iSINC system, each with a set of lane numbers between 1 and 8. In order to uniquely identify each lane at the site in the data files, each lane should be assigned a unique logical lane number. If there are eight or less lanes, the lane number and logical lane number should be set to the same number.
- **Lane State *** – the sensor array associated with the lane number is turned on or off by enabling or disabling this menu option.

The remainder of the menu contains options for the various sensors. (Loops, axle sensors, offscale and overheight sensors). Refer to section 4.3.4.3 for information on module numbering and Appendix A.1.2 for channel and module options. All sensors have the following settings in common:

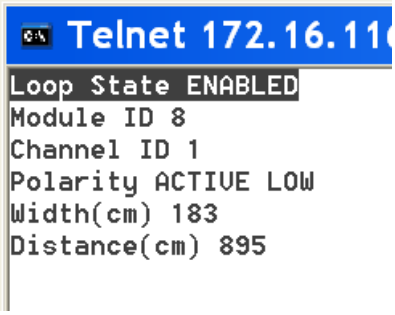
- **State *** – If the sensor is used in this array, set its state to **Enabled**, if the sensor is not present or not to be used, set its state to **Disabled**. ***Note:*** *every sensor listed must be set to the proper state, regardless of whether or not this particular system has that sensor present; having a sensor that is not present set to* ***Enabled*** *could cause problems with the operation of the system.*
  If the sensor is disabled, none of the other settings for that sensor need to be configured.
- **Module ID *** – the identification number of the iSINC module to which this sensor is connected.
- **Channel ID *** – the identification number of the channel on the module to which this sensor is connected. The number of channels available depends on the type of module; DIOM have 8 channels, LSM 4 channels, SCM 6 channels and PSM have 4 piezo and 1 temperature sensor channels. Refer to Appendix A.1.2.1 for information on channel assignments.
- **Polarity *** – the signal polarity used by the sensor; if set to **Active High**, the signal goes positive when the sensor is activated, if set to **Active Low**, the signal goes negative when active.

Upstream Loop *



- **Width *** – the distance, in centimeters, from the leading edge of the loop to the trailing edge of the loop (all distances are parallel to the direction of traffic flow).

Downstream Loop *

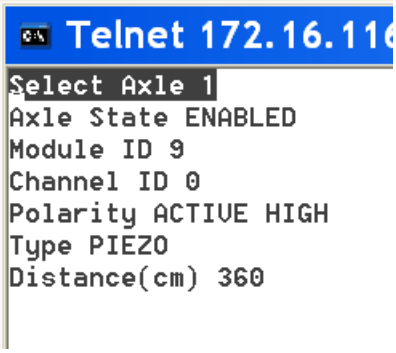


- **Width *** – the distance, in centimeters, from the leading edge of the loop to the trailing edge.
- **Distance *** – the distance, in centimeters, from the leading edge of the upstream loop to the leading edge of the downstream loop.

The sensitivity settings of both loops in a sensor array should be the same (refer to Appendix A.1.5)

Axle Sensor *

There may be up to four axle sensors in a sensor array. The axle sensors may be of different types (for example a Dynax axle sensor and two single load cell weigh pads).



- **Type *** – the type of Axle sensor. Selection choices are:

  A.7 Bending Plate – a Weigh in Motion sensor

  A.8 Single Load Cell – a Weigh in Motion sensor

  A.9 Kistler – a Kistler piezoelectric Weigh in Motion sensor

A.10 SSWIM Scale – not used for data collection

A.11 Piezo II Scale – a type II Piezoelectric Weigh in Motion sensor

A.12 On Scale – a sensor for determining whether the axle being weighed by a WIM sensor is fully on the scale or not.

A.13 Piezo – Piezoelectric Type I axle sensors are used to determine axle spacings. This axle sensor can also function as a backup speed sensor in case of a loop failure.

A.14 Dynax – Dynax axle sensors are used to determine axle spacings. This axle sensor can also function as a backup speed sensor in case of a loop failure.

- **Distance *** – the distance, in centimeters, from the leading edge of the upstream loop to the leading edge of this axle sensor.

Repeat this menu for as many axle sensors as there are in the lane.

Offscale Sensor *

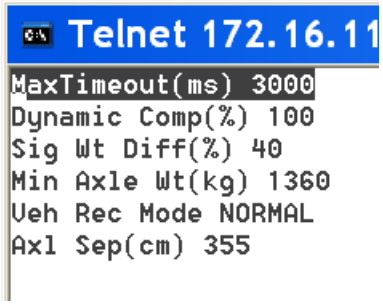
The offscale sensor detects whether the axle being weighed by a WIM sensor is partially off the scale to one side or the other.

Overheight Sensor *

An overheight sensor determines whether or not the vehicle passing through the sensor array is over the sensor height.

Processing *

The processing menu option sets the limits used to determine vehicle record errors and



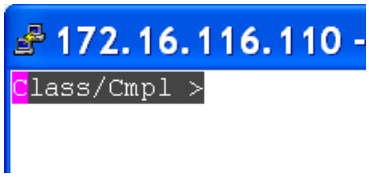
- **MaxTimeout *** – the time, in milliseconds, allowed between when the vehicle triggers the first sensor and when the vehicle will be considered to have left the sensor array and the vehicle record is finished.
- **Dynamic Comp *** – because the physical characteristics of some sites alter the dynamic load which the front axle applies to the WIM sensors, a dynamic compensation factor may be necessary to produce more accurate front axle weights. The default value of 100 makes no adjustment; a setting of 105 will multiply the front axle weight by 1.05, a setting of 95 will multiply it by .95.
- **Sig Wt Diff *** – significant weight difference; the percentage weight difference allowed between left and right WIM sensors, above which the axle weight will be flagged with a warning in the vehicle record.
- **Min Axle Wt *** – the minimum axle weight, below which the significant weight difference will not be checked.

- **Axle Separation *** – a measurement used for axle separation calculations if the sensing loops are not available. For systems with an axle sensor (Dynax or piezo type I) enter the distance from the leading edge of the axle sensor (in cm) to the leading edge of the scale sensor. For systems with only a weigh scale (no axle sensors), enter the width of the scale platform (in cm.).

Repeat the Site Parameters sub-menu for each of the sensor arrays on the site.

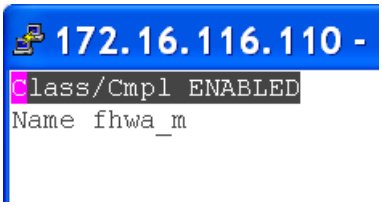
4.3.11.15 Processing *

The **Processing** menu controls the processes used to classify vehicles and to verify whether or not they are in compliance with regulations.



4.3.11.16 Class/Compliance *

The **Class/Compliance** menu controls the configuration of the vehicle classifications and regulation agency compliance factors to be used at this site.

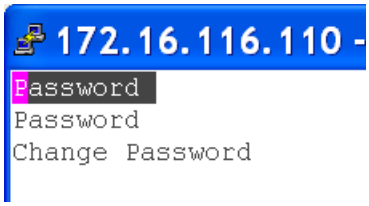


The Class/Compliance sub-menu displays whether bridge compliance formula vehicle classification is enabled or disabled and the file used for bridge compliance formula calculations.

- **Class/Cmpl *** – enables or disables the use of vehicle classification and compliance tables. If this selection is disabled, only axle weights and Gross Vehicle Weight are saved in vehicle records and used for sorting decisions; vehicles are not classified and no axle grouping (bridge formula) calculations are performed.
- **Name *** – The name of the current classification and compliance file in use is displayed. To change the file of tables used in the bridge compliance formula calculations, contact an IRD service representative.

4.3.11.17 System Passwords *

Changes the “admin” password.



To change the admin password:

- highlight the first **Password** menu option, press <***Enter***>, key in the new password, press <***Enter***>.
- highlight the second **Password** menu option, press <***Enter***>, key in the new password again, press <***Enter***>.
- Highlight the **Change password** menu option and press <***Enter***>.
  .

4.3.12 File Commands

The File Commands menu performs some basic file operations such as listing, copying, renaming, deleting , and closing files.

4.3.12.1 Directory

Selects the directory whose contents will be listed by the next menu option

4.3.12.2 Directory Listing

Lists the files (and the size of each file) from the iSINC Flash card directory selected above.

4.3.12.3 Remove Flash Card

Closes all files in preparation for removing the iSINC Flash Card.

> ***NOTE:*** *Always perform this menu option to close all system files before removing the iSINC Flash Card from its slot. If this is not done, some files on the card may be corrupted and be inaccessible.*

After the **Remove Card** menu option is selected, data will be saved in a memory buffer until the new flash memory card is installed. If the iSINC is powered down before a new card is installed, the data will be lost. Use the left arrow ← key to return to the main menu.

A.1.1 APPENDIX A – ACRONYMS AND DEFINITIONS

A.1.1.1 Acronyms

AASHTO – American Association of State Highways and Transportation Officials
ASTM – American Society for Testing and Measurement
DIOM – Digital Input/Output Module
FHWA – Federal HighWays Administration
GVW – Gross Vehicle Weight
GW – GateWay network device
IP – Internet Protocol
IRD – International Road Dynamics Inc.
iSINC - Intelligent Sensor Interface and Network Controller
KIPs – Kilo Pounds; 1000 pounds of weight
LED – Light Emitting Diode
PC – Personal Computer
PSM – Piezoelectric Sensor Module
SBM – Serial Bridge Module
SSM – Scale Sensor Module
WCU – WIM Control Unit
WIM – Weigh-In-Motion

A.1.1.2 Definitions

Bridge formula – a widely used method of calculating the allowable maximum weight of a vehicle and its axle groups based on the number and spacing of the axles. There are a number of variations to the bridge formula recognized by different regulatory agencies; iSINC provides a selection of bridge formula options.
CAN bus – Controller Area Network bus - an industry standard electronics backplane for connecting together a number of microcontroller cards that need to communicate with one another.
Module – a microcontroller electronics printed circuit board , also known as a card or board.

A.1.2 APPENDIX B – CONNECTOR PINOUTS

A.1.2.1 I/O Signal Panel Connectors

The table on the following page lists the pin assignments for the three terminal block connectors on the I/O Signal Panels.
The vertical columns in the table differentiate panels by the source of the I/O signals and the modules to which the I/O Signal panels are internally connected.
The position of the modules and I/O panels in the rack mounting are standardized and are dependant on the system options at a specific installation; refer to Appendix A.1.4 for a listing of the system configurations.

I/O Signals	Digital	Loops & LSM	Serial	Scale	Piezo	Dynax
Module Connection	**DIOM**	**LSM**	**SBM**	**SSM**	**PSM**	**DIOM**
Capacity	8 ch + 2 inv ch	4 ch in + 4 out	1 RS 232	6 channels	4 piezo + 1 temperature	8 channels
TB1 Terminations						
1	/A0	CH1_LP_A	/RI	V_EXC_A	-	-
2	Cable Shield	Cable Shield	Cable Shield	Cable Shield	-	Cable Shield
3	GND	CH1_LP_B	GND	V_EXC_COM	-	-
4	/A1	CH2_LP_A	/DTR	A+	A+	-
5	Cable Shield	Cable Shield	Cable Shield	Cable Shield	Cable Shield	Cable Shield
6	GND	CH2_LP_B	GND	A-	GND	-
7	A0	CH3_LP_A	RI	V_EXC_B_	-	D0
8	Cable Shield	Cable Shield	Cable Shield	Cable Shield	-	Cable Shield
9	GND	CH3_LP_B	GND	V_EXC_COM	-	GND
10	A1	CH4_LP_A	DTR	B+	B+	D1
11	Cable Shield	Cable Shield	Cable Shield	Cable Shield	Cable Shield	Cable Shield
12	GND	CH4_LP_B	GND	B-	GND	GND
TB2 Terminations						
1	V_EXTA_IN	-	-	V_EXC_C	-	-
2	Cable Shield	Cable Shield	Cable Shield	Cable Shield	-	Cable Shield
3	GND	-	GND	V_EXC_COM	-	-
4	A2	-	CTS	C+	C+	D2
5	Cable Shield	Cable Shield	Cable Shield	Cable Shield	Cable Shield	Cable Shield
6	GND	-	GND	C-	GND	GND
7	A3	-	TX	V_EXC_D	-	D3
8	Cable Shield	Cable Shield	Cable Shield	Cable Shield	-	Cable Shield
9	GND	-	GND	V_EXC_COM	-	GND
10	B0	-	RTS	D+	D+	D4
11	Cable Shield	Cable Shield	Cable Shield	Cable Shield	Cable Shield	Cable Shield
12	GND	-	GND	D-	GND	GND
TB3 Terminations						
1	B1	CH1_SS_OUT	RX	V_EXC_E	-	D5
2	Cable Shield	Cable Shield	Cable Shield	Cable Shield	-	Cable Shield
3	GND	CH2_SS_OUT	GND	V_EXC_COM	-	GND
4	V_EXTB_IN	CH3_SS_OUT	-	E+	-	-
5	Cable Shield	Cable Shield	Cable Shield	Cable Shield	-	Cable Shield
6	GND	CH4_SS_OUT	GND	E-	-	-
7	B2	COM_EMIT	DSR	V_EXC_F	T1_+V	D6
8	Cable Shield	Cable Shield	Cable Shield	Cable Shield	Cable Shield	Cable Shield
9	GND	M_FLT_COL	GND	V_EXC_COM	T1_-V	GND
10	B3	RESET_IN	CD	F+	T1_SIG	D7
11	Cable Shield	Cable Shield	Cable Shield	Cable Shield	Cable Shield	Cable Shield
12	GND	PS_COM	GND	F-	GND	GND

I/O Signal Panel Connections

A.1.3 LSM TO DIOM JUMPERS

The ouput signals from the Loop Sensing Modules are connected to the inputs of the Digital I/O Modules via jumpers on the I/O panels.
Each LSM can have up to 4 outputs and each DIOM can have up to eight inputs, so a DIOM can handle the signals from two LSM. The loop signals are jumpered as follows:

LSM CH	Signal I/O Panel & Terminal Block	TB connector #	TB connector #	Signal I/O Panel & Terminal Block	DIOM CH
1	LSM 1 Out on TB3	1	7	DIOM In on TB 1	A0
2		3	10		A1
3		4	4	DIOM In on TB 2	A2
4		6	7		A3
Com		7	8		GROUND
1	LSM 2 Out on TB3	1	10		B0
2		3	1	DIOM In on TB 3	B1
3		4	7		B2
4		6	10		B3
Com		7	11		GROUND

The illustration below shows the output from an LSM (four sensing loops) from the Signal I-O Panel on the left of the picture jumpered to the DIOM inputs Signal I/O Panel on the right of the picture.

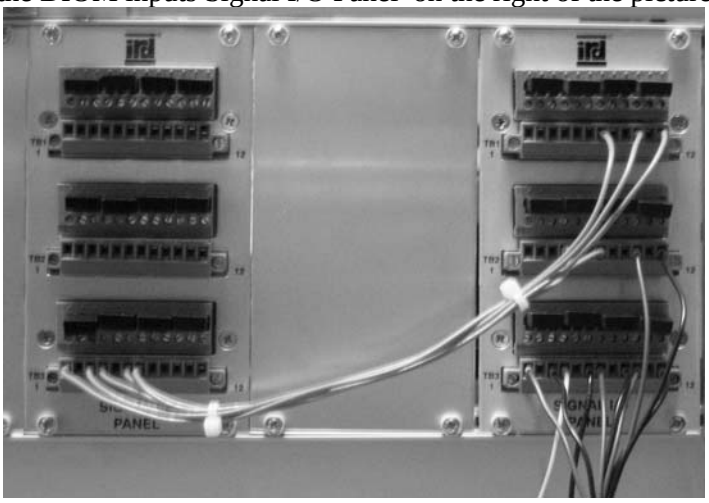
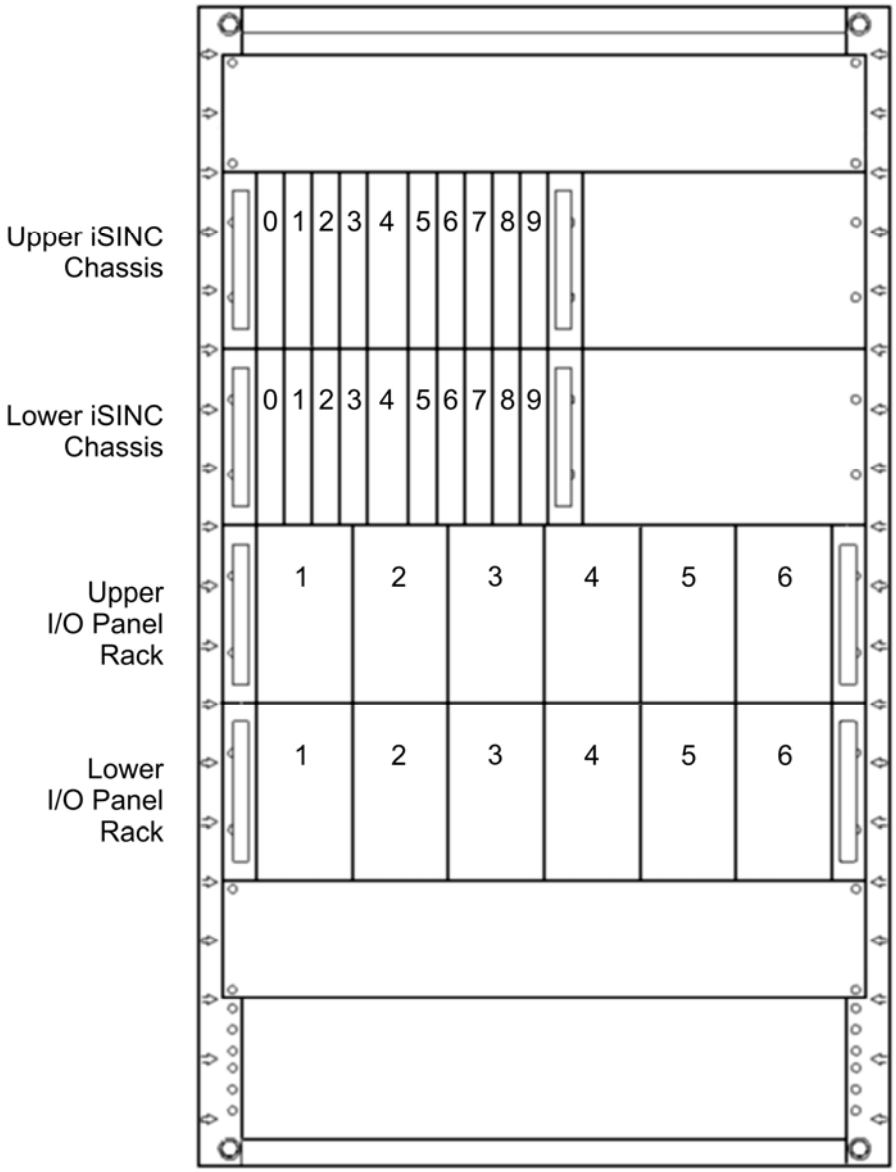


Figure 31 - LSM to DIOM jumpers

A.1.4 iSINC Module and I/O Panel Options

The tables on the following pages list the various possible configurations of iSINC modules, the sensor inputs to the Signal I/O panels and the internal ribbon cable connections between the Signal I/O panel and the module
The diagram below indicates the module and I/O Signal Panel positions referred to in the tables:



A.1.4.1 Single ISINC Chassis and I/O Panel Rack Options

Option	**4 Loops**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	blank	SBM	blank	blank	blank	blank	LSM	blank	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	blank	blank	blank	Loops, LSM 7	blank	Digital out from LSM 7, DIOM 9

Option	**8 Loops**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	blank	SBM	blank	blank	blank	blank	LSM	LSM	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	blank	blank	blank	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9

Option	**12 Loops**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	LSM	SBM	blank	blank	blank	DIOM	LSM	LSM	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	Loops, LSM 1	blank	Digital out from LSM 1, DIOM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9

Option	**16 Loops**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	LSM	SBM	blank	blank	LSM	DIOM	LSM	LSM	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	Loops, LSM 1	Loops, LSM 5	Digital out from LSM 1+5 DIOM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9

Option	**4 Loops + 4 Piezo**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	blank	SBM	blank	blank	PSM	blank	LSM	blank	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	blank	Piezo PSM 5	blank	Loops, LSM 7	blank	Digital out from LSM, DIOM 9

Option	**8 Loops + 8 Piezo**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	blank	SBM	blank	blank	PSM	PSM	LSM	LSM	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	blank	Piezo PSM 5	Piezo PSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9

Option	**4 Loops + 4 Scales**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	blank	SBM	blank	blank	SSM	blank	LSM	blank	DIOM

	Signal I/O sensor and internal connections to modules					
	1	2	3	4	5	6
Upper Rack	blank	Scale SSM 5	blank	Loops, LSM 7	blank	Digital out from LSM, DIOM 9

Option	**8 Loops + 8 Scales**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	blank	SBM	blank	blank	SSM	SSM	LSM	LSM	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	blank	Scale SSM 5	Scale SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9

Option	**4 Loops + 4 Piezo + 4 Scales**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	PSM	SBM	blank	blank	SSM	blank	LSM	blank	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	Piezo PSM 1	Scale SSM 5	blank	Loops, LSM 7	blank	Digital out from LSM 7, DIOM 9

Option	**8 Loops + 8 Scales + 4 Piezo**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	PSM	SBM	blank	blank	SSM	SSM	LSM	LSM	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	Piezo, PSM 1	Scale SSM 5	Scale SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9

Option	**4 Loops + 4 Scales + 4 Dynax**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	blank	SBM	blank	blank	SSM	DIOM	LSM	blank	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	blank	Scale, SSM 5	Dynax(4) DIOM 6	Loops, LSM 7	blank	Digital out from LSM 7 DIOM 9

Option	**4 Loops + 4 Scales + 4 Piezo + 4 Dynax**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	PSM	SBM	blank	blank	SSM	DIOM	LSM	blank	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	Piezo, PSM 1	Scale, SSM 5	Dynax(4) DIOM 6	Loops, LSM 7	blank	Digital out from LSM 7 DIOM 9

Option	**8 Loops + 8 Scales + 8 Dynax**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	TGM	DIOM	SBM	blank	blank	SSM	SSM	LSM	LSM	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	Dynax, DIOM 1	Scale SSM 5	Scale SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9

A.1.4.2 Dual iSINC Chassis and I/O Panel Rack Options

Modules from the upper chassis connect to the upper rack Signal panels, modules from the lower chassis connect to the lower rack Signal panels.

Option	**12 Loops + 12 Piezo**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	SBM	TGM	SBM	blank	blank	PSM	PSM	LSM	LSM	DIOM
Lower Chassis	SBM	blank	blank	blank	blank	PSM	blank	LSM	blank	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	blank	Piezo, PSM 5	Piezo, PSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9
Lower Rack	blank	Piezo, PSM 5	blank	Loops, LSM 7	blank	Digital out from LSM 7, DIOM 9

Option	**16 Loops + 16 Piezo**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	SBM	TGM	SBM	blank	blank	PSM	PSM	LSM	LSM	DIOM
Lower Chassis	SBM	blank	blank	blank	blank	PSM	PSM	LSM	LSM	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	blank	Piezo, PSM 5	Piezo, PSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8, DIOM 9

Lower Rack	blank	Piezo, PSM 5	Piezo, PSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9

Option	**12 Loops + 12 Scales**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	SBM	TGM	SBM	blank	blank	SSM	SSM	LSM	LSM	DIOM
Lower Chassis	SBM	blank	blank	blank	blank	SSM	blank	LSM	blank	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	blank	Scale, SSM 5	Scale, SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9
Lower Rack	blank	Scale, SSM 5	blank	Loops, LSM 7	blank	Digital out from LSM 7, DIOM 9

Option	**16 Loops + 16 Scales**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	SBM	TGM	SBM	blank	blank	SSM	SSM	LSM	LSM	DIOM
Lower Chassis	SBM	blank	blank	blank	blank	SSM	SSM	LSM	LSM	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	blank	Scale, SSM 5	Scale, SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8, DIOM 9

Lower Rack	blank	Scale, SSM 5	Scale, SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9

Option	**12 Loops + 12 Scales + 8 Piezo**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	SBM	TGM	SBM	blank	blank	SSM	SSM	LSM	LSM	DIOM
Lower Chassis	SBM	PSM	PSM	blank	blank	SSM	blank	LSM	blank	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	Piezo, PSM 1 (lower chassis)	Scale, SSM 5	Scale, SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9
Lower Rack	Piezo, PSM 2	Scale, SSM 5	blank	Loops, LSM 7	blank	Digital out from LSM 7, DIOM 9

Option	**16 Loops + 16 Scales + 8 Piezo**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	SBM	TGM	SBM	blank	blank	SSM	SSM	LSM	LSM	DIOM
Lower Chassis	SBM	PSM	PSM	blank	blank	SSM	SSM	LSM	LSM	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6

Upper Rack	Piezo, PSM 1 (lower chassis)	Scale, SSM 5	Scale, SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8, DIOM 9
Lower Rack	Piezo, PSM 2	Scale, SSM 5	Scale, SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9

Option	**16 Loops + 16 Scales + 16 Dynax**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	SBM	TGM	SBM	blank	blank	SSM	SSM	LSM	LSM	DIOM
Lower Chassis	SBM	DIOM	DIOM	blank	blank	SSM	SSM	LSM	LSM	DIOM

	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	Dynax(8), DIOM 1 (lower chassis)	Scale, SSM 5	Scale, SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8, DIOM 9
Lower Rack	Dynax(8), DIOM 2	Scale, SSM 5	Scale, SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9

Option	**8 Loops + 8 Scales + 4 Piezo + 4 Dynax**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	SBM	TGM	SBM	blank	blank	SSM	SSM	LSM	LSM	DIOM
Lower Chassis	SBM	PSM	blank	blank	blank	blank	DIOM	blank	blank	blank

	Signal I/O sensor and internal connections to modules

Panel #	1	2	3	4	5	6
Upper Rack	Piezo, PSM 1 (lower chassis)	Scale, SSM 5	Scale, SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8 DIOM 9
Lower Rack	blank	Dynax(4) DIOM 6	blank	blank	blank	blank

Option	**12 Loops + 12 Scales + 8 Piezo + 8 Dynax**									
Module#	0	1	2	3	4	5	6	7	8	9
Upper Chassis	SBM	TGM	SBM	blank	blank	SSM	SSM	LSM	LSM	DIOM
Lower Chassis	SBM	PSM	PSM	blank	blank	SSM	DIOM	LSM	blank	DIOM

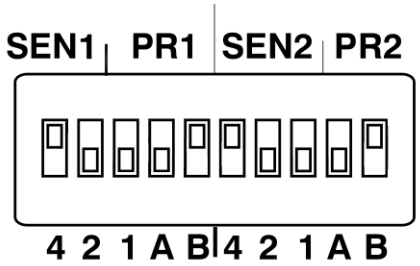
	Signal I/O sensor and internal connections to modules					
Panel #	1	2	3	4	5	6
Upper Rack	Piezo, PSM 1 (lower chassis)	Scale, SSM 5	Scale, SSM 6	Loops, LSM 7	Loops, LSM 8	Digital out from LSM 7+8, DIOM 9
Lower Rack	Piezo, PSM 2	Scale, SSM 5+6	Dynax(8) DIOM 6	Loops, LSM 7	blank	Digital out from LSM 7+8 DIOM 9

A.1.5 APPENDIX C – LSM

The Loop Sensing Module is used for vehicle detection. A vehicle passing over the loop in the road causes a change in loop inductance which is sensed by the LSM.
Each LSM has four loop channels, with one loop per channel. Each channel has independent sensitivity, presence, and frequency settings. The loop is triggered, or turned on, when a vehicle passing over it causes a change in loop inductance large enough to be detected by the Loop Detector card. The change in loop inductance L is measured as a percentage, $\Delta L/L$ (change in inductance divided by initial inductance).
The sensitivity of the channel determines the amount of change in loop inductance needed to turn the loop on. The **SEN** sensitivity DIP switches are a binary setting, with eight possible levels from 0 to 7. A channel set to a low sensitivity (0, 1, 2) requires more change in inductance to turn the loop on than a channel set to a higher sensitivity (5, 6, 7). Small vehicles, or vehicles with low metal content, will require higher sensitivities to be detected.
The presence hold time determines the amount of time that a slow or stationary vehicle on the loop will continue to be detected. After the loop is triggered, it will stay on for a maximum time of 3.5 seconds, 4 minutes, or 35 minutes, depending on the presence setting. The channel may also be disabled using the presence switches.

A.1.5.1 Configuration

Hardware configuration involves setting several switches per loop channel. The switches on the front panel control sensitivity and presence, while frequency is controlled by switches on the face of the card. On the front panel, the two switch blocks are divided into 5 switches per channel; three for sensitivity, two for presence, as shown below:



Channel Sensitivity and Presence Switches

The channel settings are shown below:

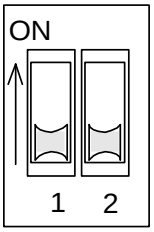
Switch Setting:			Sensitivity Level	ΔL/L
4	2	1		
off	off	off	0	1.28%
off	off	**on**	1	0.64%
off	**on**	off	2	0.32%
off	**on**	**on**	3	0.16%
on	off	off	4	0.08%
on	off	**on**	5	0.04%
on	**on**	off	6	0.02%
on	**on**	**on**	7	0.01%

Table 4 - Loop Channel Sensitivity Settings

Switch Setting		Presence Hold Time
B	A	
off	off	Channel Off
off	**on**	3.5 sec.
on	off	4 min.
on	**on**	35 min.

Table 5 - Loop Presence Settings

There is also an DIP switch block on the card for frequency; this setting should not require adjustment. The frequency of the channel determines the loop frequency. The loop frequency does not affect vehicle detection, but is used in multiple loop configurations; when there are loop lead wires running next to each other, and the loop signals do not go to the same LSM card, different loop frequencies are required to prevent crosstalk.
The frequency switches are located on the face of the LSM card and cannot be accessed while the module is in the iSINC.



Channel Frequency Switch (Default shown)

The frequency switch settings are shown below:

Switch Setting		Frequency
2	1	
off	off	High
off	**on**	Medium High
on	off	Medium Low
on	**on**	Low

Table 6 - Loop Channel Frequency Settings

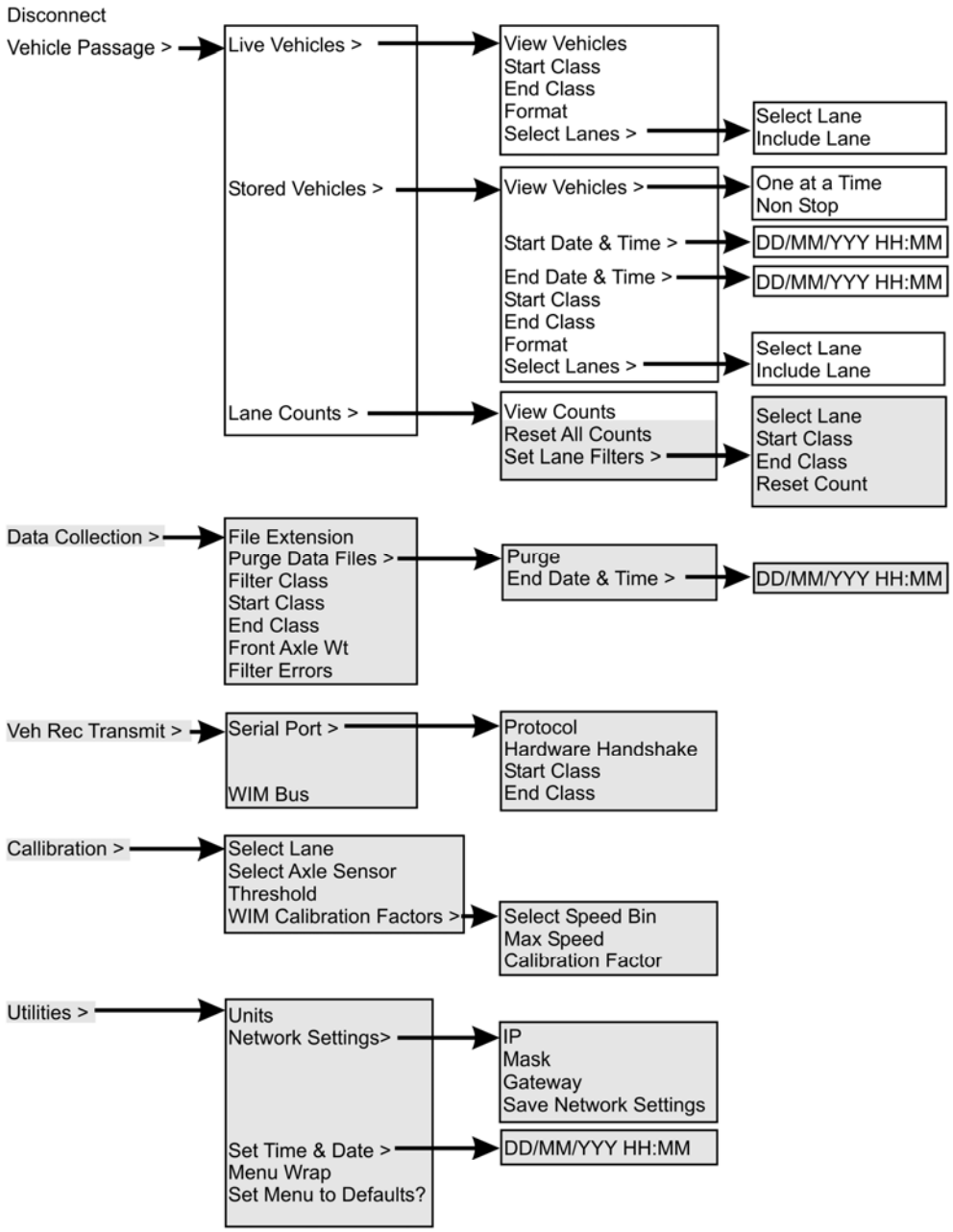
Appendix D – Signal I/O Over-Voltage Protection

Solid state transient over-voltage protection device manufactured by Krone Inc., part no. 6659 2 060-03.

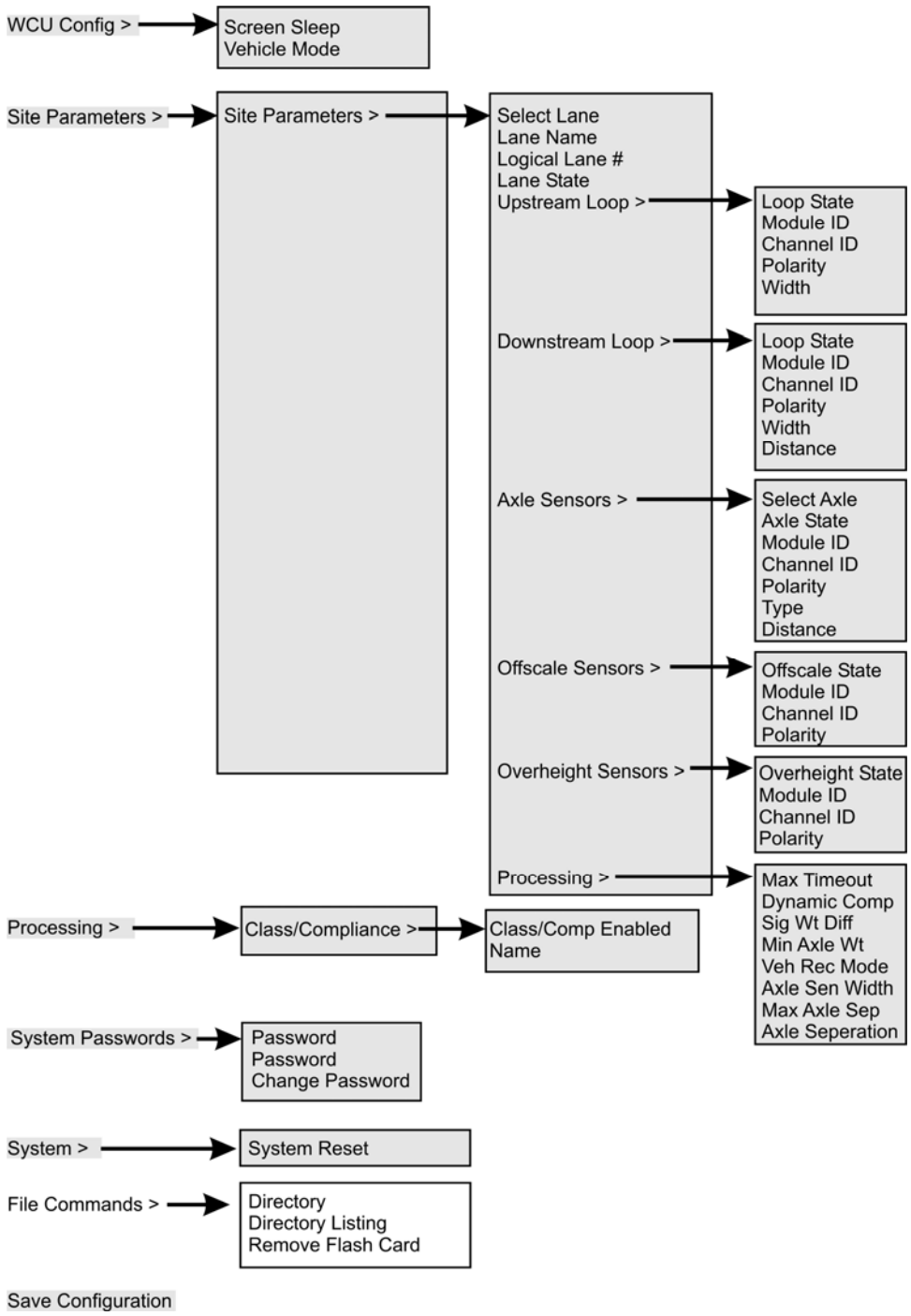
Package	Modified TO-220	
Pins for peak off-state voltage V_{DRM}-1	Pins(V_{DRM}-1)	1-2, 2-3
Peak off-state voltage	V_{DRM}-1 (V)	270
Switching voltage	V_S @ V_{DRM}-1 (V)	350
Pins for peak off-state voltage V_{DRM}-2	Pins(V_{DRM}-2)	1-3
Peak off-state voltage	V_{DRM}-2 (V)	270
Switching voltage	V_S @ V_{DRM}-2 (V)	350
On-state voltage	V_T Max (V)	8.0000
On-state forward voltage	V_F (V)	0
Leakage current	I_{DRM}	5
Switching current	I_s Max (mA)	800
Holding current	I_H Min (mA)	150
Off State Capacitance	C_O (pF)	0
Peak Pulse Current – 2 x 10Aμs	I_{PP} 2 x 10Aμs	250
Peak Pulse Current – 8 x 20Aμs	I_{PP} 8 x 20Aμs	250
Peak Pulse Current – 10 x 160Aμs	I_{PP} 10 x 160Aμs	150
Peak Pulse Current – 10 x 560Aμs	I_{PP} 10 x 560Aμs	100
Peak Pulse Current – 10 x 1000Aμs	I_{PP} 10 x 1000Aμs	80
Peak Pulse Current – 5 x 310Aμs	I_{PP} 5 x 310Aμs	0
Peak Pulse Current – 5 x 320Aμs	I_{PP} 5 x 320Aμs	0
Peak Pulse Current – 10 x 700Aμs	I_{PP} 10 x 700Aμs	0
Peak one cycle surge current	I_{TSM} 60Hz (A)	30
Current rise rate	*di*/*dt* Max (A/Aμs)	500

A.1.6 APPENDIX E – ISINC DATA COLLECTION MENU TREE

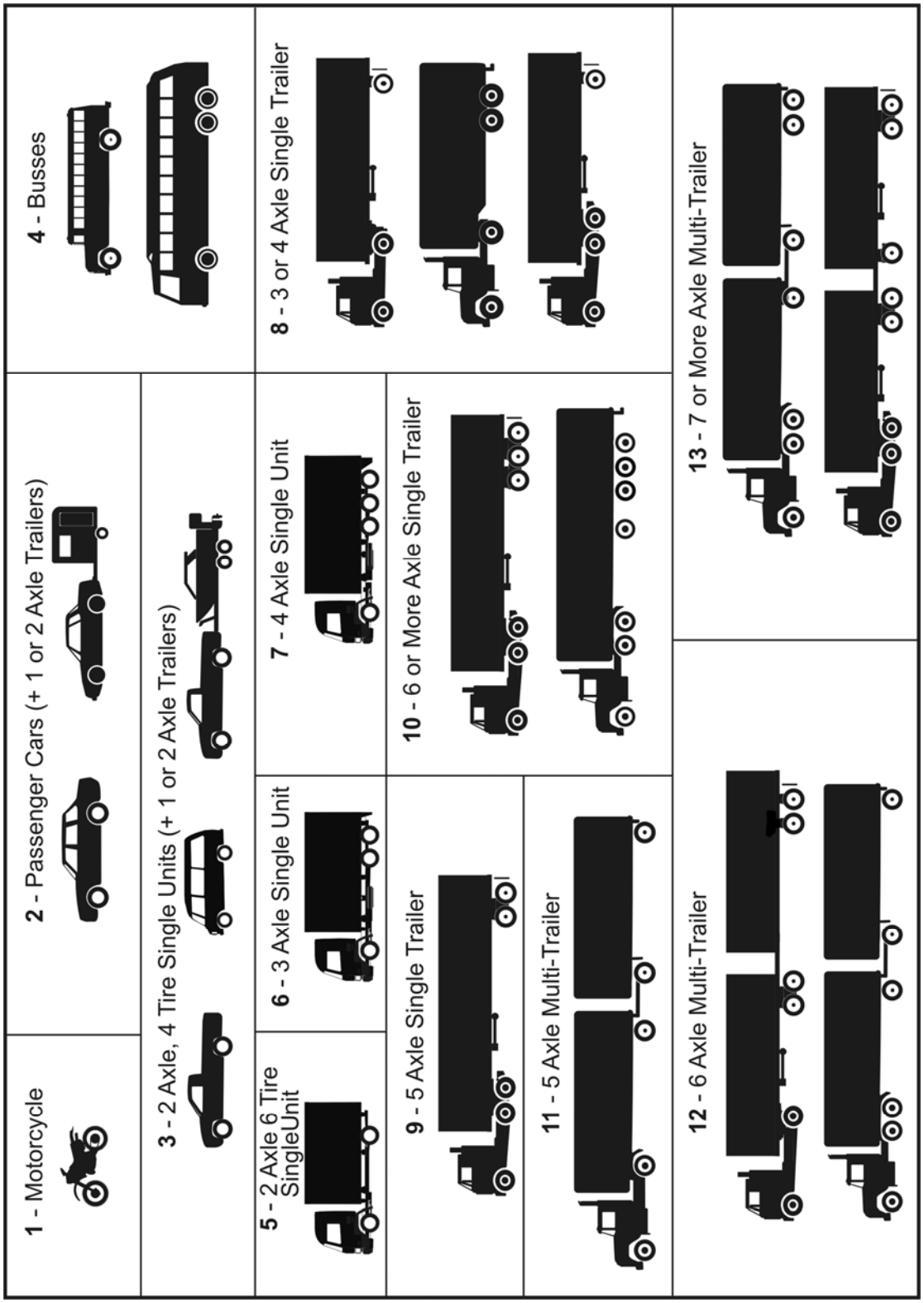
Main Menu:



Menu Options with a gray background are available only to Administrative level users


WCU Config >
Screen Sleep
Vehicle Mode
Site Parameters >
Site Parameters >
Select Lane
Lane Name
Logical Lane #
Lane State
Upstream Loop >
Loop State
Module ID
Channel ID
Polarity
Width
Downstream Loop >
Loop State
Module ID
Channel ID
Polarity
Width
Distance
Axle Sensors >
Select Axle
Axle State
Module ID
Channel ID
Polarity
Type
Distance
Offscale Sensors >
Offscale State
Module ID
Channel ID
Polarity
Overheight Sensors >
Overheight State
Module ID
Channel ID
Polarity
Processing >
Max Timeout
Dynamic Comp
Sig Wt Diff
Min Axle Wt
Veh Rec Mode
Axle Sen Width
Max Axle Sep
Axle Seperation
Processing >
Class/Compliance >
Class/Comp Enabled
Name
System Passwords >
Password
Password
Change Password
System >
System Reset
File Commands >
Directory
Directory Listing
Remove Flash Card
Save Configuration

A.1.7 APPENDIX F – FHWA VEHICLE CLASSES



5 PAT Bending Plate

5.1 Brochure

INTERNATIONAL ROAD DYNAMICS INC.
www.irdinc.com

BENDING PLATE

We make highways talk™

- *MANAGEMENT*
- *SAFETY*
- *PRESERVATION*

International Road Dynamics Inc. develops and maintains traffic management products and systems technology that make highways talk. What are they saying? They are providing information that roadway administrators need to manage traffic, preserve infrastructure and provide safety warnings to drivers.

IRD's multi-discipline, innovative and customer-focused team is expert in advanced technologies, advanced traffic solutions and custom-designed systems.

The "**Bending Plate**" from IRD-PAT Traffic is used for Weigh-In-Motion (WIM). The importance of measuring the loads of driving road vehicles has increased enormously. Traffic safety, the protection of the infrastructure road and statistical data are the main purpose of Weigh-In-Motion equipment.

The stationary weighpads are delivered in two sizes for different width of lanes: **WP 1250 and WP 1750**

FEATURES

- Excellent long term stability
- Speed range: 5 to 200 km/h
- Robust
- Long life time (> 10 years)

APPLICATION EXAMPLES

- Traffic monitoring
- Road maintenance planning
- Overload detection
- Toll applications
- Statistical purpose

DESCRIPTION

The foundation is made of high-strength steel plates. On the bottom side two slots are milled for the incorporation of wire strain gauges. The wire strain gauges are bridged to a Wheatstone-Bridge with supplementary fixed resistors for temperature compensation. The supply voltage and the output signal are carried in a shielded 4 conductor cable inserted through a hole with waterproof fitting.

The whole weighpad is covered with a neoprene rubber film hot vulcanised on. Along the longitudinal borders two rubber tapes, used as bearings, are vulcanised on the bottom side.

For fixing the weighpad, it is bevelled on both sides at the longitudinal borders and supported by two bevelled strips in a foundation frame.

The foundation frames are tied firmly in the road surface by a special installation procedure. Details are described in a separate installation manual.

CUSTOMER DRIVEN

OCTOBER, 2003 REV A
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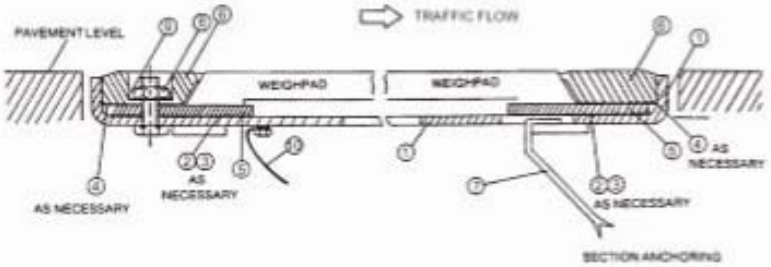
IRD reserves the right to change, modify, or improve its products at any time without notice.

BENDING PLATE

Technical Data

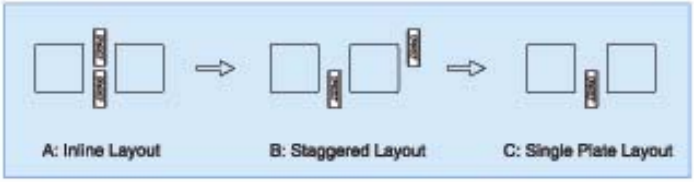
Weight:	81 kg for 1250 mm version
	114 kg for 1750 mm version
Sensor Dimensons:	508 x 1250 x 23 mm (WP1250 mm)
	508 x 1750 x 23 mm (WP1750 mm)
Nominal Load:	10.000 kg
Carrying capacity:	15.000 kg
Temperature range:	-40°C .... +80°C (stock and operation without damage)
Temperature range:	-10°C .... +50°C (compensated)
Continual stock temperature:	+15°C ....+30°C (more than 3 months)
Air humidity:	10% 99%
Uninterrupted water influence:	< 300 hours

Temperature drift sensitivity:	± 0.01% / °C
Temperature drift zero point:	± 0.2% / °C
Linearity (increasing load):	± 0.7% from measuring range
Traverse sensitivity:	± 1.5% from measuring range
Sensitivity (10t):	± 0.8 (0.6) mV/V typ.
Length of connecting cable:	40 m (standard)
Number of conductors:	4 + shield
Input resistance:	675 ohms (975 ohms)typ.
Output resistance:	600 ohms (840 ohms) typ.
Insulation resistance:	> 100 MOhms
Supply voltage:	24V DC (30V DC max.)
Max.voltage measuring circuit shield:	100 V
Natural frequency:	215 Hz



1) Foundation Frame
2) Shim 1/32"
3) Shim 1/16"
4) Shim 1/16"
5) Support rail, ¼"
6) Securing rails, 7/8" galvanised
7) 10x anchors, painted
8) 12x self-locking nuts, galvanised
9) 12x spring washers, galvanised
10) 1x ground wire, #8 bare copper, 18"

TYPICAL INSTALLATION SCHEMES AS EXAMPLE



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1002 S. Main Street
Chambersburg, PA
USA 17201
Tel: 1-877-444-4IRD (4473)
Fax: (306) 242-5599

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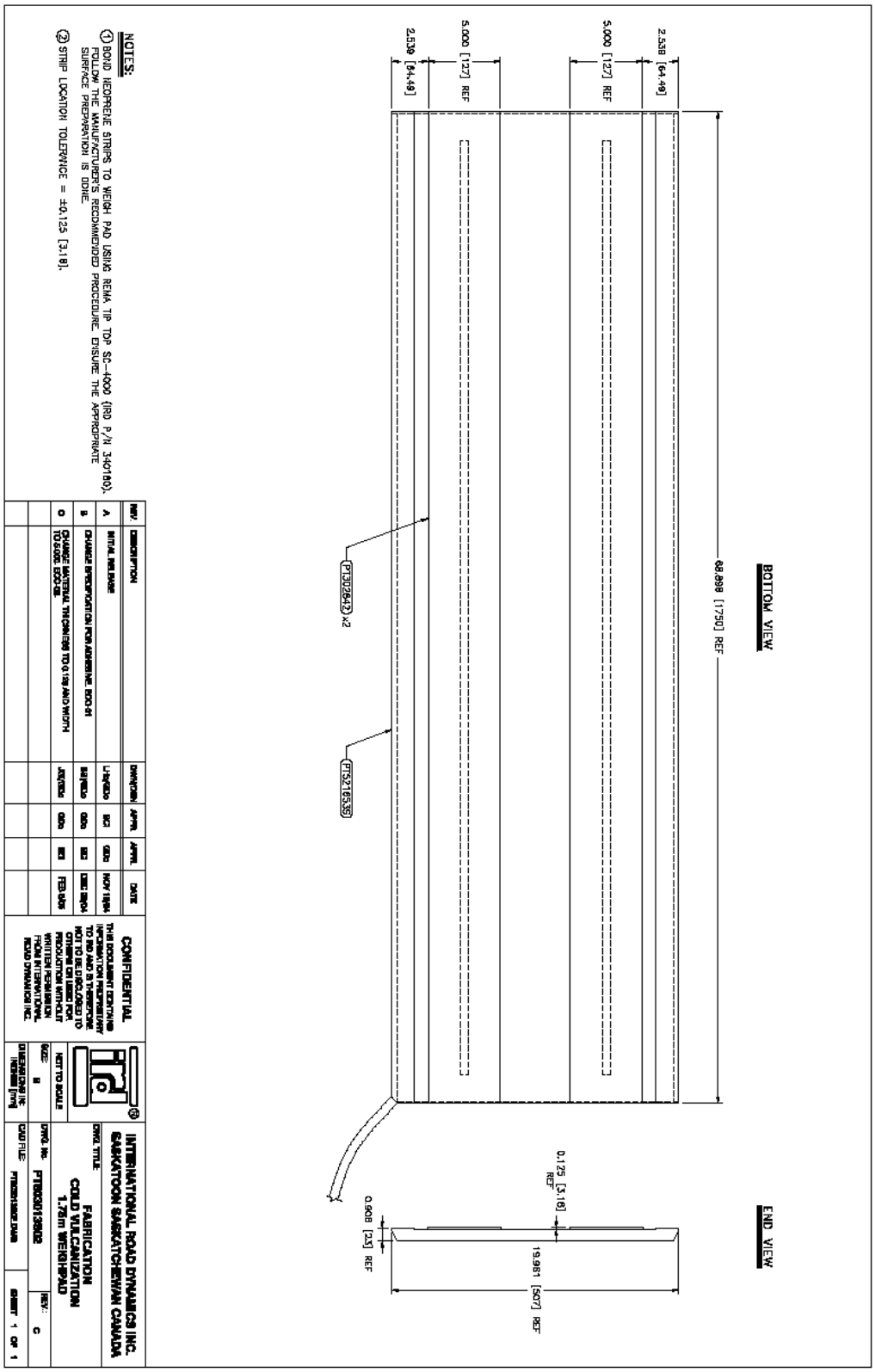
BOTTOM VIEW
68.898 [1750] REF
2.539 [64.49]
5.000 [127] REF
5.000 [127] REF
2.539 [64.49]
PT302542 x2
PT521855
END VIEW
0.125 [3.18] REF
19.981 [507] REF
0.908 [23] REF
NOTES:
1. BOND NEOPRENE STRIPS TO WEIGH PAD USING REMA TIP TOP SC-4000 (IRD P/N 340180). FOLLOW THE MANUFACTURER'S RECOMMENDED PROCEDURE. ENSURE THE APPROPRIATE SURFACE PREPARATION IS DONE.
2. STRIP LOCATION TOLERANCE = ±0.125 [3.18].
REV. DESCRIPTION DWN/DSN APPR. APPR. DATE
A INITIAL RELEASE LV-NOBO SC1 GBD NOV 1994
B CHANGE DESCRIPTION FROM ADHESIVE. ECO-01 BM NOBO GBD SC2 DEC 1994
C CHANGE MATERIAL THICKNESS TO 0.159 AND WIDTH TO 0.908. ECO-08 JKS/GBD GBD SC3 FEB 1995
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INTERNATIONAL ROAD DYNAMICS INC.
SASKATOON SASKATCHEWAN CANADA
DWG. TITLE:
FABRICATION
COLD VULCANIZATION
1.78m WEIGHPAD
NOT TO SCALE
SIZE: B
DWG. No: PT1800013280/02
REV: C
CAD FILE: PT1800013280/02.DWG
SHEET 1 OF 1

5.2 Installation Instructions

INSTALLATION INSTRUCTIONS

STATIONARY WEIGHPAD AND 69"/1.75M FRAME

PAT America, Inc.
1665 Orchard Drive
Chambersburg, PA 17201
Phone: 717-263-7655
FAX: 717-263-7845
Web: www.patamerica.com
email: info@patamerica.com

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Subject to technical modifications without notice.

1. GENERAL INFORMATION

The stationary weighpads of the dynamic axle load scales are subject to extreme strain in normal traffic such as high, abrupt load changes, temperature fluctuations, water, etc.

To run the system for a reasonable period without failures, it is important to install the foundation frames and weighpads very carefully in accordance with these instructions. It is recommended that the first installation always be done under the supervision of a specialist.

Weighpad foundation frames can be installed into any normal roadway surface, asphalt or concrete, if the compacted upper layer of the pavement is more than 6" (15 cm) thick. The frame, including the weighpad embedded in it, has a total height of 2¼" (6 cm) in the support area. Installation is made into the wearing course without special foundation. If the compacted pavement is less than 6" (15 cm) thick, a foundation socket of concrete has to be built under the frame, just as wide as the frame. The anchors are inserted into bores of 1" (2.5 cm) diameter and reach down into the base course approximately 8" (20 cm). **In case of reinforced concrete pavement, consult the construction engineer before cutting.**

The following aspects have to be observed when choosing the installation site for the weighpads:

- It is possible for water to penetrate into the frame or under installed weighpads. This leads to false axle load measurements, especially in the winter when water freezes under the weighpads. Therefore, it is necessary to install a drain pipe at the lowest point of the frame recess. The drain should be 2"–4" (5 cm - 10 cm) diameter and sloping into a french drain, water shaft or culvert.

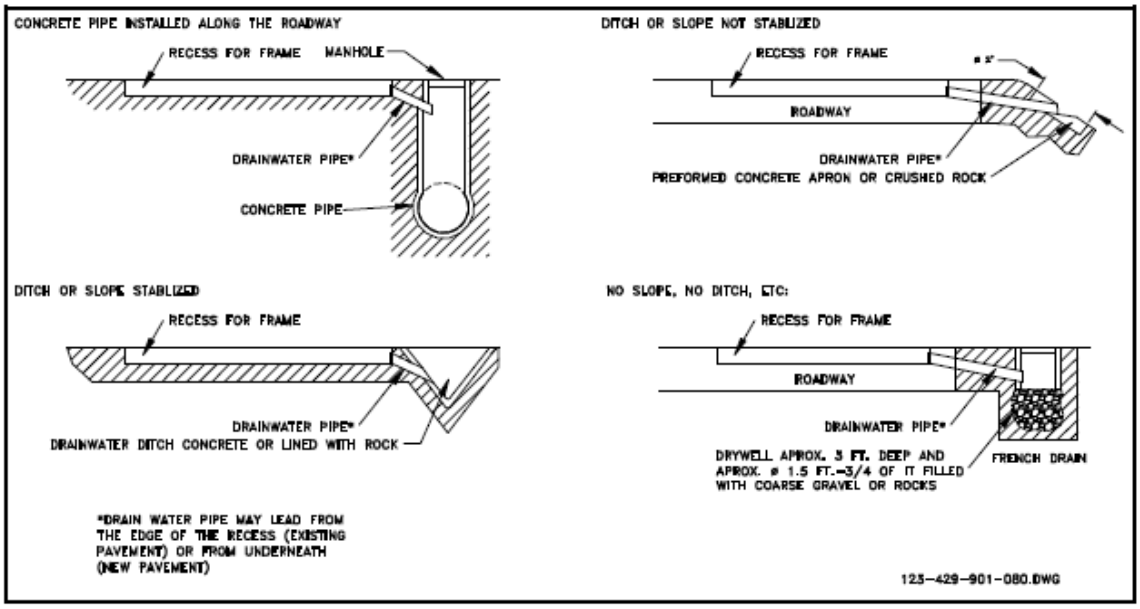


Figure 1 - Drainage Styles

- The roadway is part of the WIM system and therefore must be as flat and uniform as possible for approximately 200' (60 M) before and 50' (15 M) after the weighpad. For increased accuracy requirements, evenness must meet ASTM1318 specifications, at a minimum must not exceed 1/10" (0.25 cm) in 13' (4 M).

  ASTM 1318 requires a stretch of 150' before and 150' after the scale to be level within the evenness tolerance. PAT only requires a 50' stretch after the scale, but 200' before the scale to be level.

- Vehicles to be measured must be able to pass over the weighpads without accelerating or braking.

- The entire measuring distance must be straight, with no curves or grades. The longitudinal slope must not exceed 3% for statistical traffic data registration or 1% for weighstations. A transverse slop of approximately 1% at weighstations is desirable to avoid hydroplaning.

- Wheel grooves existing in the measuring area must be removed.

- Trucks, when passing the measuring spot, must not appear to bounce. Profilograph records do not always show the long wave repeating unevenness which can create high dynamic axle weight variations.

- In case of doubt, contact PAT America, Inc. for verification. PAT reserves the right to refuse a site if the above conditions are not met.

A Site Survey Sheet (form number 123-422-000-630, see the appendix) has to be completed, and the site conditions have to be accepted by both PAT and the user.

2. PREPARATION

To avoid unnecessary waiting periods during installation it is important to compile and check all construction tools listed below before beginning. This is particularly important if there is a time limit for blocking the road.

2.1 Construction Tools Required for Installation

Heavy Equipment:

Item	Quantity	Description
1	1	Air Compressor, 160CFM minimum.
2	1	Air driven Rock Drill, with 1" diameter 20" long bit.
3	1	Air driven Hammer (typically 60 lbs.), with 1" chisel and 3" - 4" spade bits, and appropriate safety equipment.
4	1	Air blow-wand.
5	1	Concrete saw (recommend 11 or more horsepower) with diamond blades.
6	1	Ditch digger or Backhoe for conduit trenches.
7	1	AC Generator (recommend 4KW or larger) and 150' extension cables.
8	1	Water for concrete cutting and washdown.
9	1	If installing below 50 °F (10 °C), a gas space heater or torpedo heater and two sheets 4'x8' plywood.
10	1 set	Conduit cutting and threading tools, up to the maximum size of conduit specified.

Power Tools:

Item	Quantity	Description
1	1	Industrial 3/4" drill, approximately 200 RPM, with heavy-duty mixer attachment 16-20" long.
2	1	Angle Grinder with cutoff wheels and grinding wheels for steel and rocks, with safety glasses.
3	1	Industrial vacuum cleaner.
4	1	Propane gas burner, for drying pavement.
5	1	Air or electric impact wrench with 3/4" socket.
6	1	Torque wrench with 3/4" socket, rated to at least 100 Ft–Lb.
7	1	Hand tools and accessories consisting of: Tin snips Hack saw 2-5 lb hammer Caulk guns
8	1	Pick, shovel, broom, spade, trowel, and wheel barrow.
9	3 each	2" and 4" plastic putty knifes, wire bristle brush. *These items will be destroyed in the installation process due to drying epoxy.*
10	1	Chalk, marking paint, and string
11	2	4' Bubble level.
12	1 each	10-15' straight edge, measuring wedge, and 100' tape measure.
13	per person	Latex gloves, safety glasses, and protective clothing.
14	1 set	Frame installation / leveling aids, two per frame. Reusable, but recommend four per installation to increase speed.
15	1	Fish tape, recommend 100'.

2.2 Installation Materials

Item	Quantity	Description
1	1 per frame	Approximately 7 gallons of two-part filled epoxy. Recommended brand is "E–Bond G–100," shipped in 2.7 gallon cans.
2	Per site plans	Galvanized steel conduit as per site plan, for cables and drain water. If the conduit has to be installed in the road surface, choose a diameter of 1-½" or 2" for crush strength. If there is a possibility of installing the conduit below the frame and road surface, choose a diameter of 2" to 3", for maximum ease of cable installation and to avoid future maintenance issues. For the drain water, PVC pipe can be used if crush strength is not a concern.
3	Per site plans	Elbows, galvanized, diameter matching item #2.
4	Per site plans	Conduit grounding bushings for weighpad frames and all junction boxes.
5		#8 solid copper ground wire.
6	Per site plans	Pullboxes
7	80lb per frame	Portland cement, without rocks.
8		Marking tape (length depending on ditch length). The plastic tape with red and white stripes is inserted before closing the ditches. It is used as a warning in the event of future earthmoving operations.
9	3 per frame	Caulk tubes of silicone sealer.
10	1 oz. per frame	Anti-seize grease
11	1	Roll of 2" duct tape
12	4	Parts to construct frame leveling aids. These consist of: 3' section of 2x4 2 6" sections of ½-20 threaded rod 4 ½-20 nuts 4 ½ flat washers

13	1	Spray paint (epoxy paint) with primer, black.
14	1' per frame	1" flexible PVC conduit or "smurftube," if loop lead-i cables are routed through the weighpad conduits.

2.3 Foundation Frame Parts Breakdown

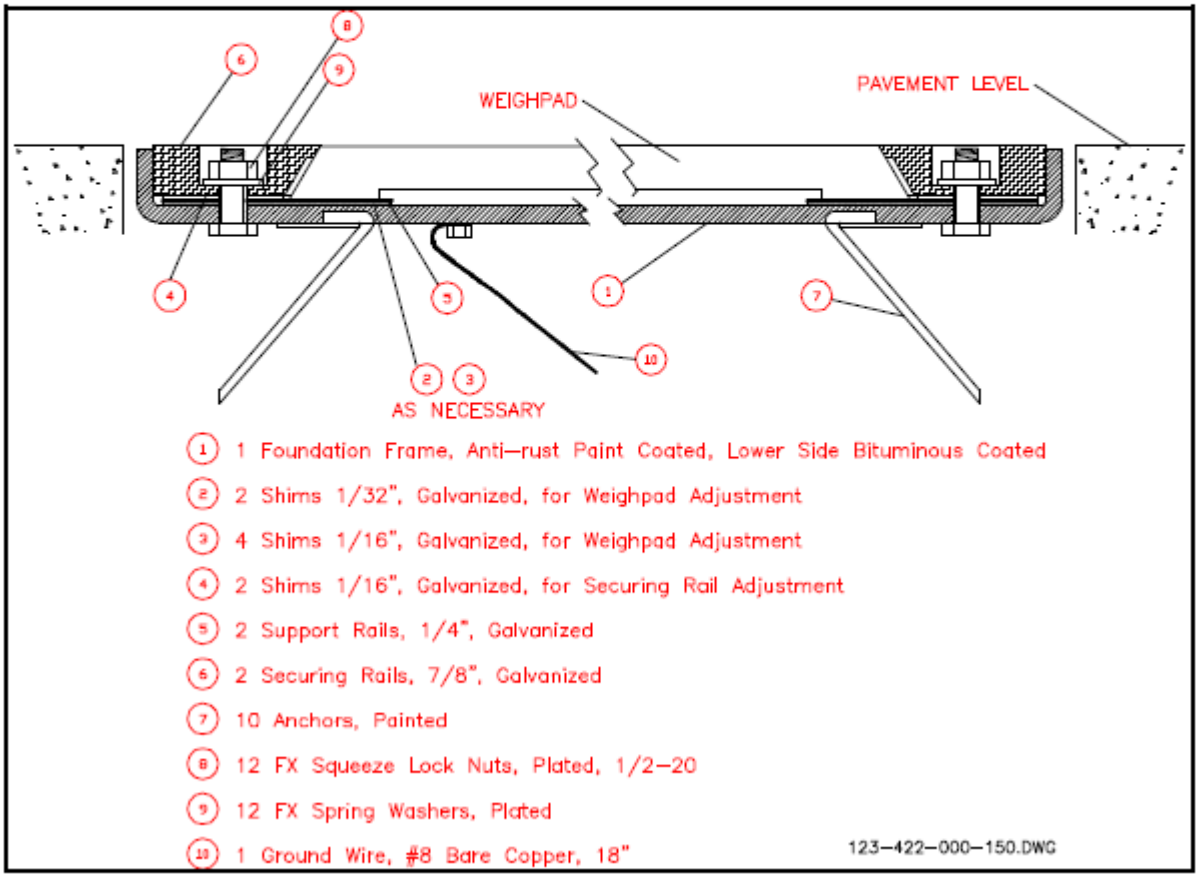
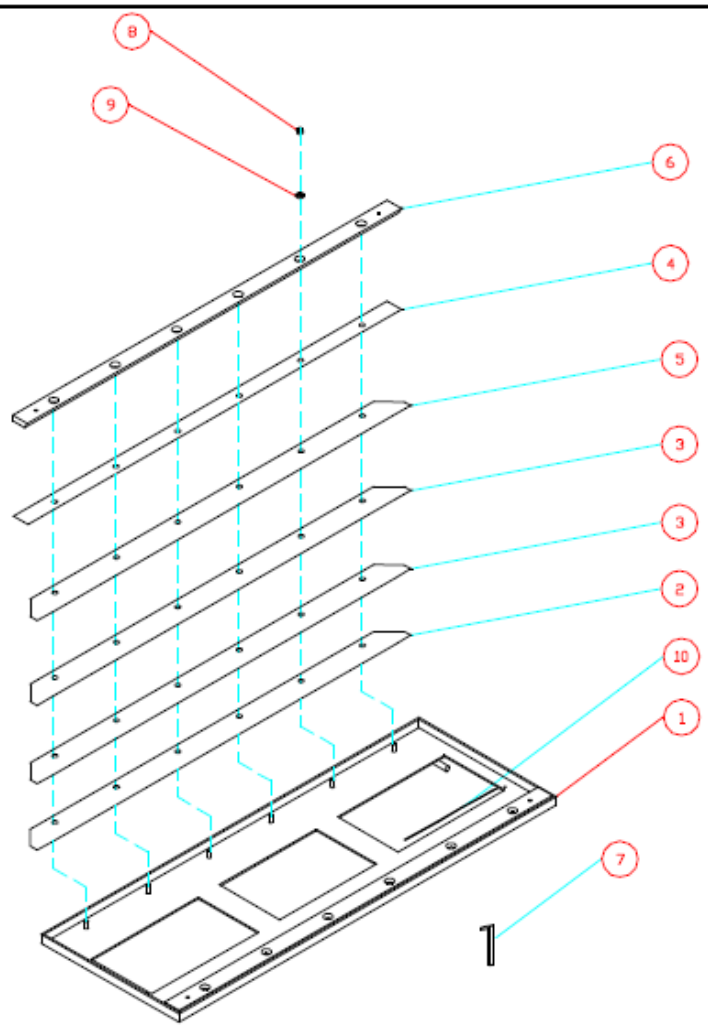


Figure 2 - Frame Illustrated Parts Assembled



1. 1 Foundation Frame, Anti–rust Paint Coated, Lower Side Bituminous Coated
2. 2 Shims 1/32", Galvanized, for Weighpad Adjustment
3. 4 Shims 1/16", Galvanized, for Weighpad Adjustment
4. 2 Shims 1/16", Galvanized, for Securing Rail Adjustment
5. 2 Support Rails, 1/4", Galvanized
6. 2 Securing Rails, 7/8", Galvanized
7. 10 Anchors, Painted
8. 12 FX Squeeze Lock Nuts, Plated, 1/2–20
9. 12 FX Spring Washers, Plated
10. 1 Ground Wire, #8 Bare Copper, 18"

123–429–901–050.DWG

Figure 3 - Frame Illustrated Parts Breakdown

! Ensure sufficient protection of the job site.

! With chalk and marking paint, mark the exact installation points for frames and induction loops as well as for drain pipes and cable conduits. See site-specific diagrams provided by PAT.

If the conduits and drains were precast into the concrete slab, verify placement accurately. The drains must be centered under the weighpad in the traffic direction.

Observe squareness to the traffic direction.

Figure 4 - Laying out Site 123-429-901-120.JPG

! Cut the marked frame border 2-¼" (6 cm) deep with a concrete saw. Do not crosscut over corners to avoid the risk of future breaking. Then cut the surface to be broken out for the frame into pieces as per drawing. Do not crosscut over the edges. Then cut the excavation for drain water pipe and cable conduit to 4" (10 cm) deep.

In case of reinforced concrete, consult the construction engineer before cutting.

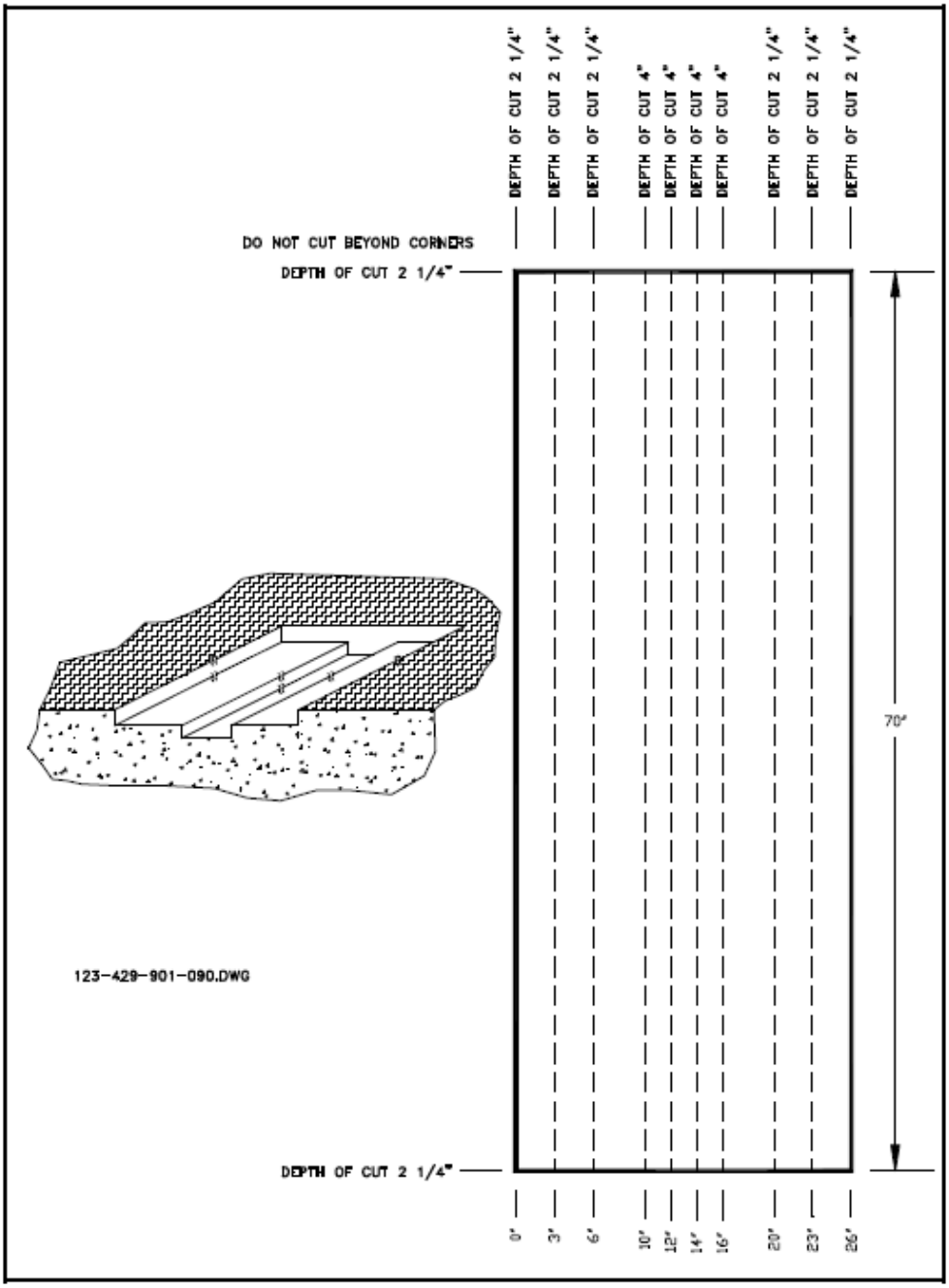


Figure 5 - Frame Recess Cutting Diagram

Figure 6 - Cutting Frame Recess 123-429-900-950.JPG

! Cut induction loops. See site-specific diagrams provided by PAT.

! Excavate frame recess with a compressed air hammer.

Figure 7 - Excavated Recess

123-429-901-130.JPG

! Cover inside of frames and bolts with duct tape to prevent excess epoxy from adhering to the frame. Leave the anchor holes uncovered. This will save significant time in cleaning the frame and bolts from overflow epoxy.

! Attach frame leveling aids to frames. These are constructed from 2x4 stock.

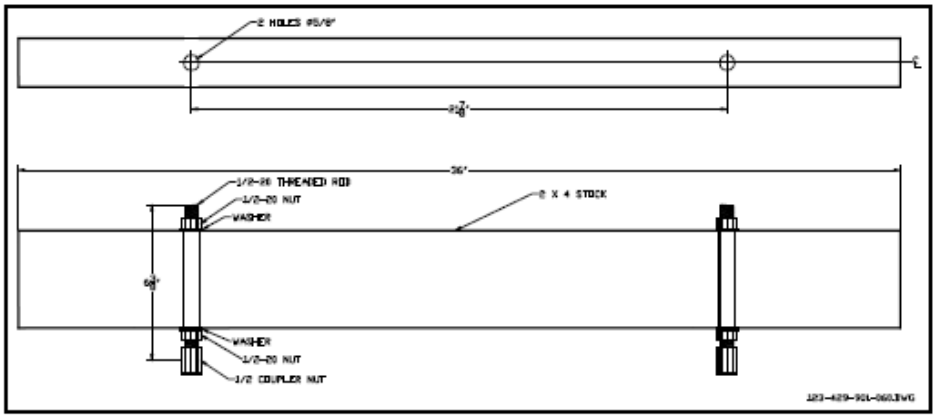


Figure 8 - Frame Leveling Aid

! Check depth of the cutout by inserting frame into recess. Mark breakouts with marking paint for the cable tube welded to frame, and anchors holes.

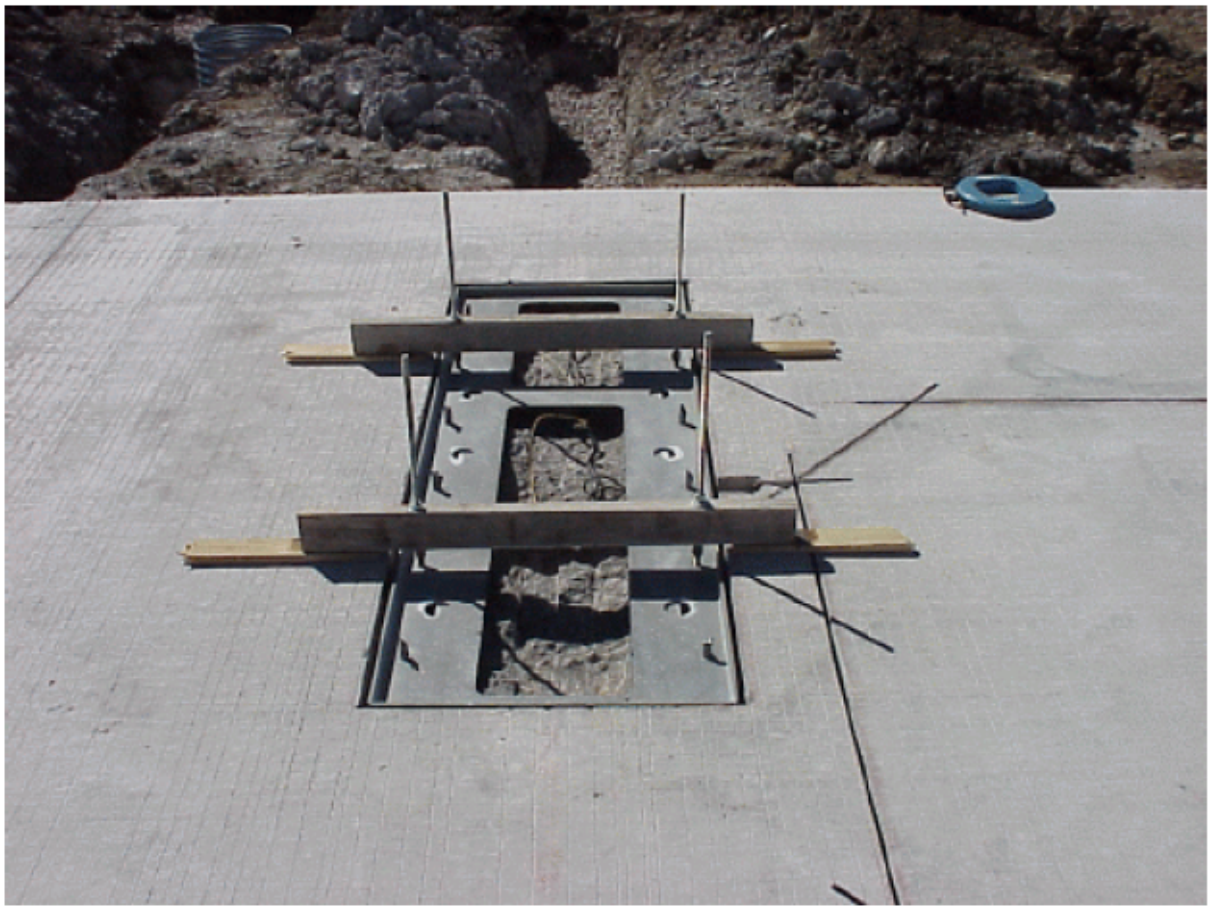


Figure 9 - Frame in Recess 123-429-900-960.jpg

! Take the frame out of recess and drill anchor holes. Start vertically to about ½" depth, then slowly turn to a 45° angle.

Figure 10 - Drilling Frame Anchor Holes123-429-900-970.jpg

! Clean frame recess and anchor holes with compressed air. Dry with a propane gas burner if necessary. <u>The surface must be dry and clean.</u> <u>Epoxy will only adhere to dry and clean rock, concrete, or asphalt surface.</u>

Figure 11 - Drying Recess with Propane123-429-901-110.jpg

! For inline weighpads that are inline or in adjacent lanes, install a 2" conduit or appropriate length between the weighpads.

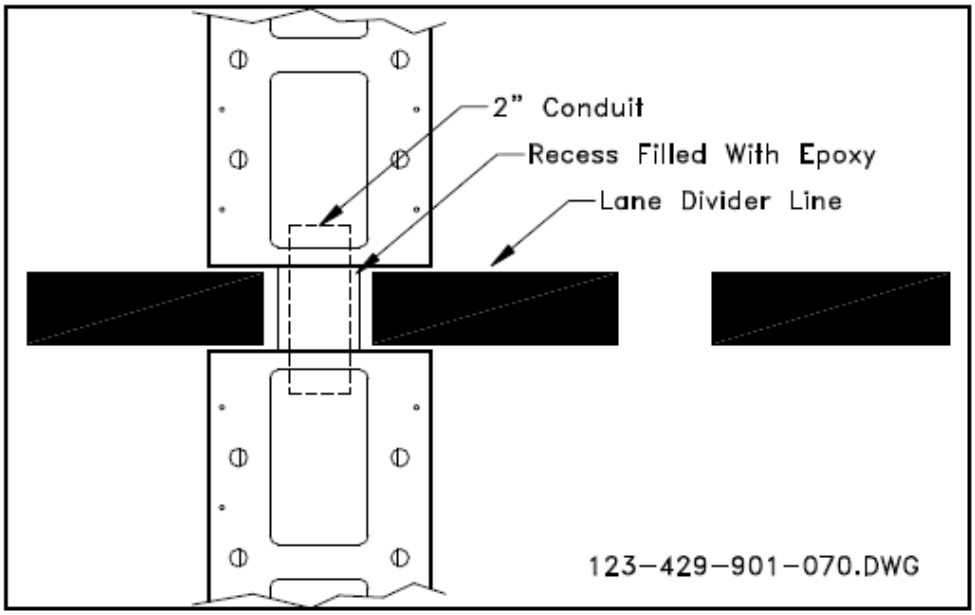


Figure 12 - 2" In-line Cable and Drainage Conduit

! Install the drain and cable conduit, if not already stubbed-in as with new concrete installations.

! Place frame in recess. Adjust the height of the frame so that studs are 1/16" or less below road surface. All studs must be below the road surface, but not more than 3/32". Tighten lower nuts against leveling aid, and verify frame height.

! Mix the portland cement, somewhat dry, and build cement walls. The walls are only used to keep epoxy in place after pouring. The frame can be used for leveling.

Figure 13 - Creating Cement Walls 123-429-900-980.jpg

! Remove excessive concrete and other loose debris in the bearing area and clean the bearing area with compressed air and/or vacuum cleaner. <u>This step is very important</u> as any debris will reduce the bonding effect.

! Check the bottom of the frame. Remove any debris which might adhere to the bituminous coating.

! Seal off ends of cable and drain conduits with duct tape.

! Attach #8 solid copper bonding wire(s) to the frame.

! Set frame close to the recess.

! When working with epoxy resin, wear appropriate protective clothing. Note the following important points:

- It is important to remember that water is an enemy of all epoxy resin adhesives. Therefore, the installation and in particular the support areas of the frames and anchor holes must be dry.

- Do not use epoxy remaining on the edges of the bottom of the container. This has not been mixed thoroughly with the hardener, and therefore will not set properly.

- At temperatures below 50°F, preheat the epoxy to about 80°F. At temperatures above 80°F, store the epoxy and hardener in a room with temperature below 75°F. For installations in extreme temperature conditions, contact PAT for instructions.

- Expect a working time of approximately three to five minutes above 70°F, ten minutes between 60 and 70°F, and 15 or more minutes below 60°F.

- For further information on epoxy, see "Processing Instructions" in the E–Bond G–100 appendix.

! Without adding the hardener, premix epoxy in sufficient quantity (three buckets per frame). The filled epoxy settles significantly during shipping.

! Add the hardener, and mix another two to three minutes, especially at the edges. Processing time and setting time vary with temperature.

! Pour the epoxy into anchor holes first, then into the bearing area outside the cement retaining wall. The level should come up to the indentation formed by the frame on the cement wall.

Figure 14 - Pouring Epoxy 123-429-900-990.jpg

! Apply the epoxy with a wire brush to vertical edges of the frame recess to obtain maximum bonding and eliminate air pockets. Epoxy will not adhere otherwise and can cause early loosening of the frame.

! Immediately afterwards press the frame into the epoxy and insert the anchors. Remove epoxy overflowing into the frame immediately. Make sure the frame rests completely on epoxy. If pockets of air are suspected underneath the frame, immediately lift frame and fill with more epoxy.

The epoxy may not fill up to the road surface. It must completely fill up to the top level of the steel frame.

Figure 15 - Removing Excess Epoxy 123-429-901-000.jpg

! Insert anchors down as far as possible. They must not protrude into the weighpad area. Weigh down the frame with 50-100lb objects until epoxy has set.

Continue to remove epoxy overflowing into the frame, to make later cleanup easier.

Figure 16 - Driving in Anchors 123-429-901-010.jpg

! Install other inline frames one after another (as described before), making sure there is no gap between frames.

! When epoxy has set after approximately 30-60 minutes (refer to E–Bond epoxy curing chart in the appendix), remove leveling aids, remove duct tape, and clean frames. Grinding may be necessary to remove excess epoxy.

Do not use the grinder to clean epoxy on or near the mounting bolts.

Figure 17 - Grinding Frame Clean 123-429-901-020.jpg

! Make electrical ground connections with #8 bare copper wire **UNDERNEATH** the frame at the provided ¼" bolts between frame and cable conduit.

! At each mounting stud, measure necessary shim thickness. This can be measured by placing a straightedge in the direction of traffic, measuring the depth of the frame, and subtracting 1-¼".

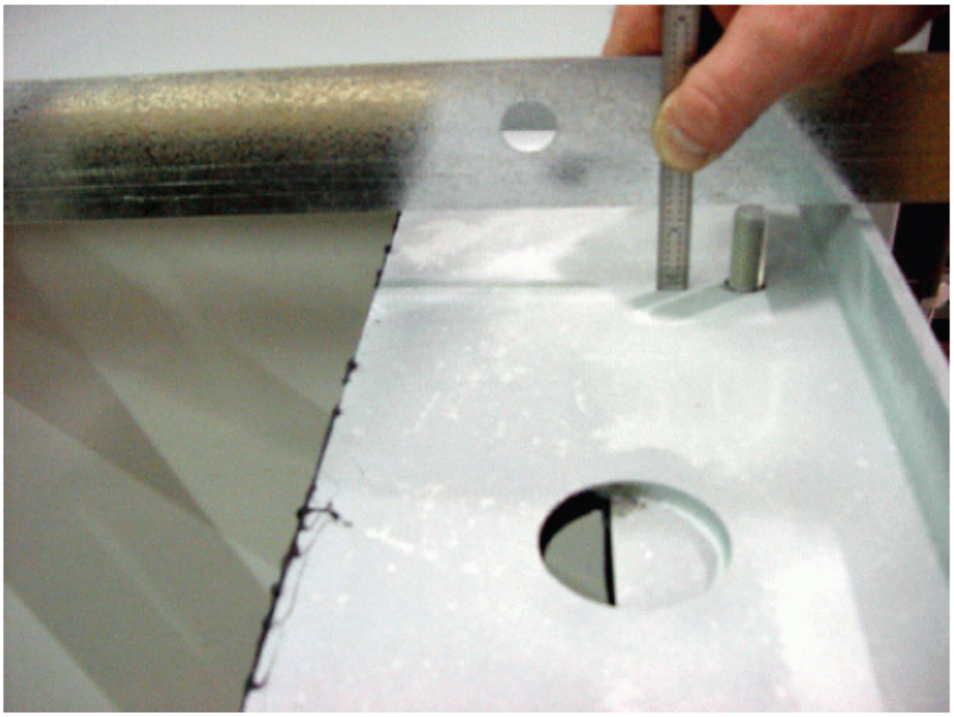


Figure 18 - Measuring Shim Height 123-429-901-140.jpg

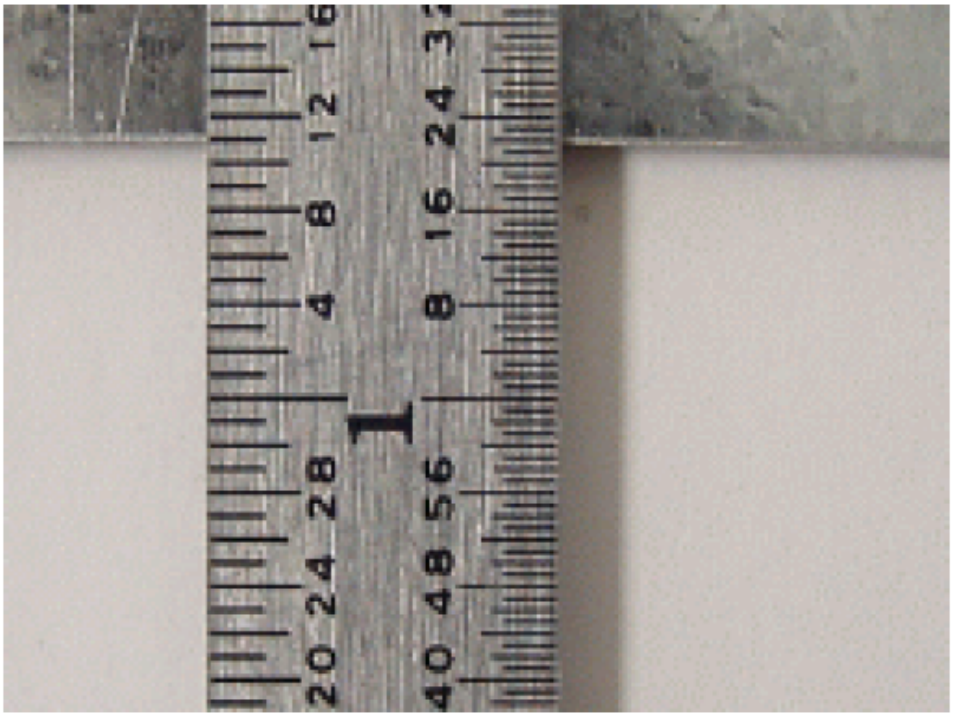


Figure 19 - 3/32" Required Shim Thickness 123-429-901-150.jpg

! Figure out the necessary shim thickness across each side of the frame, in terms of 1/16" and 1/32" shims. Exact level is important in the wheel track.

If the frame was mounted in an oblique position, cut the shims to corresponding lengths to insert them in a staggered form. Shims may only be cut in the center between two bolts, not at the bolts. Not more than one shim can be cut between the same two bolts.

In some cases, the thickness change across the length of the frame may be more than can be adjusted only cutting one shim between bolts. Use an adjusted average in this case.

For example:

5/32"	1/32"	3/32"	2/32"	3/32"	5/32"

Would become:

4/32"	2/32"	3/32"	2/32"	3/32"	5/32"

Which would result in the shims:

1/16"	1/16"	1/16"	1/16"	1/16"	1/16"
1/16"		1/32"		1/32"	1/32"
					1/16"

When cutting shims, note that the shim near the cable conduit must have an extra corner cutout to allow the cable clearance.

! Insert shims into the frame to compensate for the difference if height as calculated.

! Insert ¼" support rails into frames over shims.

! **IMPORTANT NOTICE**: Be sure not to damage the bottom side of the weighpad. Keep the weighpad in its shipping case as long as possible, and immediately set it into the frame after unpacking it. NEVER LAY THE WEIGHPAD ON THE ROAD ON ITS BOTTOM SIDE. NEVER PULL OR TWIST THE CABLE, AND AVOID LOOPS.

! Set weighpad onto two wooden pieces with its upper side close by the frame and carefully push connecting cable through the cable tube.

Figure 20 - Installing Weighpad 123-429-901-030.jpg

! Insert one securing rail shim on the side away from the weighpad. The shim should lay towards the outside of the frame.

! Insert the weighpad centrally into the frame with the cable end first, then lower the other end down to 1" and let go. Ensure the weighpad is against, but not on, the securing rail shim. Insert one securing rail shim on the other side of the weighpad.

! Place silicone in the cable entry conduit, and around where the cable comes out of the weighpad. This is to keep debris out, not to prevent entry of water.

! Grease each ½" bolt in the frame as well as the silicone rubber strip on the securing rails with anti-seize.

! Insert the securing rails and attach with locking nuts and spring washers provided. Run the nuts down snug, using a staggered pattern. This will ensure the weighpad is centered in the frame. Then tighten the nuts with a torque wrench to 85 Ft-Lb torque, again in a staggered pattern.

Figure 21 - Tightening Securing Rails 123-429-901-040.jpg

! Verify that weighpad corresponds to roadway level over entire width by means of a straight edge. If weighpad is lower by more than 1/32", adjust shims accordingly and check again. **Allowable tolerance is ±1/32".**

! Install other weighpads in the same manner. Before inserting the last weighpad, pull connecting cable through the conduit. Make sure the cable is not subject to torsion, does not form any loops, and is not bent. Leave slack underneath the frame of about 2', to allow for maintenance removal of the weighpad.

! Carefully cut off protruding red silicone rubber from securing rails. Do not cut into the weighpad rubber, or the connecting cable.

! Seal with silicone the joints between weighpad, frame, and securing rails on the short ends. Also, fill each recessed nut hole with silicone. This is to keep debris out, not to prevent entry of water.

! Open the roadway to traffic after the epoxy, silicone, and loop sealant have cured sufficiently. See the appropriate data sheets for cure time charts. This is usually one to five hours, depending on temperature.

6 Modem

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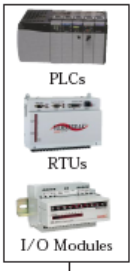

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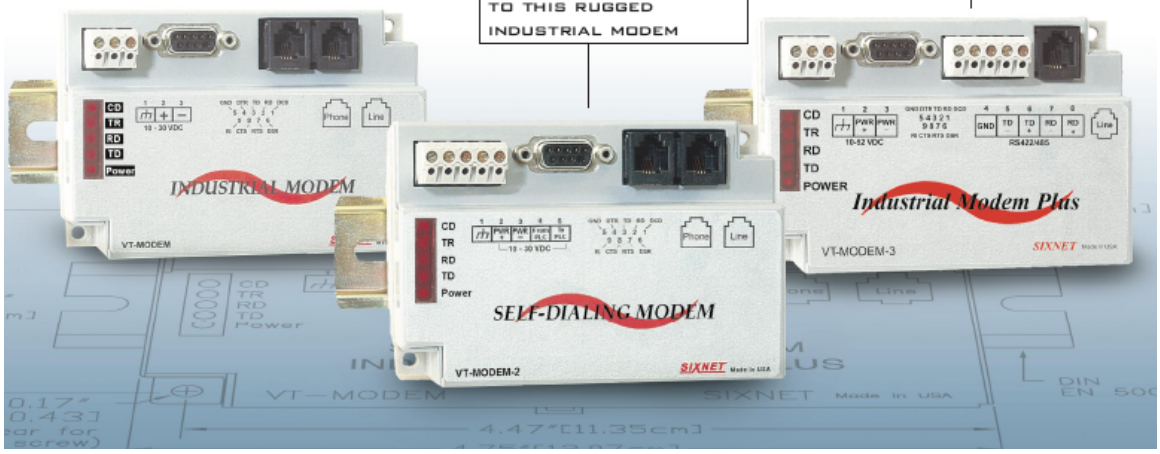

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SIXNET industrial modems work reliably through the dead of winter to those hot summer days. Unlike ordinary modems that are intended only for use in air conditioned offices, SIXNET industrial modems are designed for those places that you don't want to be - over the temperature range of -30º to 70ºC.

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SIXNET industrial modems contain an industrial version of the same modem chip-set found in PC internal modems. They support the full set of modem (AT) commands, protocols and operating features, and are 100% Windows software ready.

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Industrial Modem Selection Guide

Industrial Feature Designed to Make Your Job Easier	SIXNET MODEM-1 General	SIXNET MODEM-2 Self-Dialing	SIXNET MODEM-3 RS485 Port	Office-grade External Modems
DIN Rail or flat panel mounting	Yes	Yes	Yes	No
UL508 (electrical control enclosure) rated	Yes	Yes	Yes	No
CE rated for European and International use	Yes	Yes	Yes	?
Compliant with International phone systems	Yes	Yes	Yes	?
RS232 port	Yes	Yes	Yes	Yes
RS485 port for 2 wire or 4 wire operation	No	No	Yes	No
Auto-answer for unattended remote locations	Yes	Yes	Yes	Yes
Auto-dials from a simple contact closure	No	Yes	No	No
Dials upon an alarm in any PLC	No	Yes	No	No
Powered directly from 12 or 24 VDC source	Yes	Yes	Yes	No
Powered directly from 48 VDC source	No	No	Yes	No
Does not need a cumbersome wall-mount Transformer	Yes	Yes	Yes	No
Rated for tough industrial environments	Yes	Yes	Yes	No
Operates outdoors without requiring a heater	Yes	Yes	Yes	No
Will survive the heat in your control cabinet	Yes	Yes	Yes	No
Includes internal surge protection	Yes	Yes	Yes	No
Rated for Class I, Div. 2 (zone 2) hazardous locations	Yes	Yes	Yes	No
Auto-select or fixed rate up to 33.6K bits/sec	Yes	Yes	Yes	Yes
Replaces old 1200, 2400 or 9600 baud modems	Yes	Yes	Yes	?
100% Windows software compatible	Yes	Yes	Yes	Yes
100% compatible with the modem in your PC	Yes	Yes	Yes	Yes
Supplied with RS232 cable to make setup easier	Yes	Yes	Yes	No
Long-term support for OEMs and end users	Yes	Yes	Yes	No
Protected by an extended industrial warranty	Yes	Yes	Yes	No
Designed to make your job easier	Yes	Yes	Yes	No

Ordering Information

Modem Type	US Part Number*	Price	EC Part Number*	Price	World-Wide Part Number*	Price
General Purpose	VT-MODEM-1US	$340	VT-MODEM-1EC	$340	VT-MODEM-1WW	$360
PLC Self-Dialing	VT-MODEM-2US	$450	VT-MODEM-2EC	$450	VT-MODEM-2WW	$470
RS422 / RS485	VT-MODEM-3US	$410	VT-MODEM-3EC	$410	VT-MODEM-3WW	$430
Extended Warranty	Extend the warranty period from 12 months to 3 years				VT-CARE-36	$35
All modems include a RS232 modem cable (DB9) and complete Windows software CD, at no extra cost.						

* Location Codes
US For use in U.S., Canada, Mexico, Central and South America
EC For use in Europe, Asia, Africa, Australia and New Zealand
WW For world-wide use. OEMs install and test it here — use it there.

** All prices given are in U.S. Dollars

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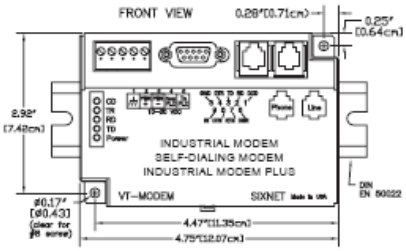
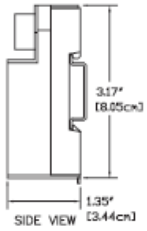
VT-MODEM Performance Specifications	
Telephone Line	
Max. data rate	33.6 kbps (V.34)
Compatibility	V.34, V.32 bis, V.32, V.22, V.22A/B, V.23, V.21, Bell 212A and 103
Data compression	V.42 bis MNP 5
Error correction	V.42 MNP 2-4
Max. fax rate	14.4 kbps
Fax capabilities	Group 3 (V.33, V.17, V.29, V.27 ter, V.21)
Ringer equivalent	0.3
Line / Auxiliary jack	RJ11
RS232 Port	
Max. RS232 Rate	115.2 kbps (Kilobaud)
RS232 (DB9 female)	TD, RD, CTS, RTS, CD, DTR, DSR, RI, GND
Command Set	All standard AT and S register commands, incl. Class 1 & 2 Fax
Status LEDs	
CD (Carrier detect) TR (Terminal Ready)	Carrier detected on the phone line Host connected and ready
RD (Receive Data)	Data is coming from the serial port
TD (Transmit Data)	Data being sent out the serial port
Power	On when power is present
General Characteristics	
Input power	10-30 VDC (VT-MODEM-1 & -2)
Input power	10-52 VDC (VT-MODEM-3)
Input current	65 mA @ 24 VDC
Operating Temp.	-30° to 70°C (-40° to 85°C storage)
Humidity	5% to 95% RH (non-condensing)
Flammability	UL 94V-0 materials
Telecom Certification	FCC part 68, Industry Canada CS03-8, CTR21 (98/482/EC); ACA TS 001-1997; ACA TS 002-1997
Electrical Safety	UL 508, CSA C22.2/14; EN61010-1 (IEC1010), IEC 950: 1991, AS/NZS3260-1993 CE
EMI emissions	FCC part15, ICES-003, Class A; EN55022; AS/NZS3548-1995 CE
EMC immunity	EN50082-1 (IEC801-2, 3, 4) CE
Surge withstand	IEEE-472 (ANSI C37.90)
Vibration	IEC68-2-6
Hazardous locations	UL 1604, CSA C22.2/213-M1987, (Class I, Div 2, Groups A, B, C, D) Cenelec EN50021 (EEx nA II T4)
Mounting	DIN rail or panel mount
PLC Discrete I/O Interface (VT-MODEM-2 Only)	
"Trigger" Input	Connects to PLC output. Starts auto-dialing when TRUE.
Voltage range	9 to 30 VDC (6.5 mA at 24 VDC)
Max OFF voltage	5 VDC
"On-line" Output	Output is ON as long as a connection exists (carrier detect).
Output type	Sourcing — switches supply power
Max. output current	100 mA
RS422 / RS485 Port (VT-MODEM-3 Only)	
RS422 mode	Supports 4 wire full duplex
RS485 modes	2 or 4 wire party-line operation
Signal rate	Standard rates up to 115.2 kbps
RS422/485 distance	Up to 0.5 miles

Mounting Dimensions



Note: Screw holes are provided as an alternative to DIN rail mounting.



Complete documentation

is provided on the SIXNET CD or may be downloaded from www.industrialmodem.com. Includes applications help for many common situations.

Contact your SIXNET Applications Engineer today!

For instant availability and the latest product information check out www.industrialmodem.com

05.15.03 Final Modem Brochure_r04.qxd

SIXNET

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7 Pull Box

1-800-GRAYBAR

Contact Us

Products are continually being added. For assistance, contact your local Graybar representative.

Item Details

Category	Enclosures, Underground - Boxes
Mfg Name	Strongwell-Quazite
Mfg Part Num	PG1730BA24
Graybar ID	94070839
Description	Enclosure, Box, Underground, 17 X 30 in, Stackable Box with Open Bottom, Precast Polymer Concrete
Application	Splice Box, Pull Box, Equipment Enclosure
Approvals	UL
Brand or Series	Quarzite, PG Series
Dimensions	19-1/4 X 32-1/4 X 24 D Inch
Features	Straight Sides for Easy Adjustment of Box to Grade, Lightweight, High Strength, Corrosion Resistant
Load Rating	Tier 22, 22568 Lbs Design, 33852 Lbs Test
Material	Precast Polymer Concrete
Nominal Size	17 X 30 Inch
Type	Stackable Box with Open Bottom
Weight	122 Lbs

Return

8 Material Safety Data Sheets (MSDS)

8.1 E-Bond Epoxy

MATERIAL SAFETY DATA SHEET

E-BOND EPOXIES, INC.
P.O. BOX 23069 / 501 N.E. 33 STREET
PH: (954)566-6555

FT. LAUDERDALE, FLORIDA 33307
EMERGENCY PHONE: (800) 255-3924

PRODUCT NAME: **E-BOND G-100 EPOXY GROUT EPOXY RESIN A** **DATE: 06/16/0**

I. INGREDIENT

	C.A.S NO.	OSHA – ACGIH TLV - TWA ppm	TLV - TWA mg/m3	STEL ppm	STEL mg/m3	PERCENT
Modified Epoxy Resin	Trade Secret	25ppm	N/E	50ppm	N/E	
***Crystalline Silica	14808-60-7	10	0.5	N/E	N/E	>80.00%

* N/E = Not Established

*** Exposure to Silica is applicable only when cured with Component "B" and sanded.

II. EMERGENCY OVERVIEW

HMIS HEALTH	2	FLAMMABILITY	1	REACTIVITY	0

PHYSICAL FORM: Neutral Heavy Liquid
COLOR: Beige
HUMAN HAZARDS: May be irritating to the eyes and skin. Contact with hot material can cause thermal burns. May cause skin sensitization.
SAFETY HAZARDS: Material will not burn unless preheated.
EXTINGUISHING MEDIA: Water spray, carbon dioxide, dry chemical, foam.

III. PHYSICAL DATA

Form:.....Neutral Heavy Liquid
Color:.....Nuetral
Boiling Point:.....N/A
Solubility in Water..... Neglible
Vapour Pressure..... ... 1.0 mbar at 25°C(77°F)
Relative Density...:.....2.05 – 2.14
Solubility in Water.....N/A
Specific Gravity:..... < 1.13 WATER=1
Percent Volatile:.....N/A
Volatile Organic Compounds:.....N/A
Voc Less H2O & Exempt Solvents:.....N/A
PH:.....N/A
Melting Point.....N/A
Appearance and Odor.....Nuetral,

IV. FIRE & EXPLOSION DATA

Flash Point:.....> 73°C (164°F)
Flammable Limits - LEL:.....N/D
Flammable Limits - UEL:.....N/D
Autoignition Temperature:.....N/D
Fire Hazard Classification: ..... N/D
(OSHA/NFPA)
Extinguishing Media

Water fog or fine spray, carbon dioxide, dry chemical, foam. Do not use direct water stream. May spread fire. Alcohol resistant foams (ATC type) are preferred if available. General purpose synthetic foams (including AFFF) or protein foams may function, but much less effectively. Water fog, applied gently may be used as

blanket for fire extinguishment. Material will not burn unless preheated. Personnel in vicinity and downwind should be evacuated.

Special Equipment for Fire-Fighters
Do not enter confined space without bunker gear (helmet with face shield, bunker coats, gloves and rubber boots), including a positive pressure NIOSH approved self-contained breathing apparatus.

V. STABILITY/REACTIVITY/TOXICOLOGICAL PROPERTIES

CHEMICAL STABILITY: Stable

CONDITIONS TO AVOID (if unstable): Avoid high temperatures.
INCOMPATIBILITY (Materials to Avoid): Can react vigorously with strong oxidizing agents, strong lewis or mineral acid, and strong mineral and organic bases. Avoid contact with water or liquids. Do not allow molten product to contact water or other liquids. This can cause violent eruptions, splatter hot material or ignite flammable material. Reaction with some curing agents may produce considerable heat and possible violent decomposition.

HAZARDOUS DECOMPOSITION PRODUCTS: Hazardous decomposition products depend on temperature, air supply and the presence of other materials. Uncontrolled exothermic reaction of epoxy resins release phenolics, carbon monoxide and water.

HAZARDOUS POLYMERIZATION: Will not occur by itself. Masses of more than one pound (0.5 kg) of product plus an aliphatic amine will cause irreversible polymerization with considerable heat build-up.

CONDITIONS TO AVOID (if polymerization may occur): Not applicable

ACUTE ORAL TOXICITY (LD50, RAT): >2000.00 mg/kg

ACUTE DERMAL TOXICITY (LD50, RABBIT): >2000.00 mg/kg (estimate)

OTHER DATA: Toxicity data from similar products. Industrial chemicals such as this material with acute toxicity values shown above and whose vapors or mists are not likely to be encountered by humans when used in any reasonably foreseeable manner would not require a toxic label according to U.S. domestic and international transport regulations.

ADDITIONAL DATA:
Eye Irritation: Mild irritation [rabbit] (material tested- Glycidyl Ether).

Skin Irritation: Draize – 3.4-5.7 [rabbit, 24 hour(s)] (material tested- Glycidyl Ether).

Carcinogenicity: Recent 2-year bioassays in rats and mice exposed by the dermal route to the diglycidyl ether of Bisphenol A (BADGE) yielded no evidence of carcinogenicity to the skin or other organs. This study clarifies prior equivocal results from a 2-year mouse skin painting study, which were suggestive but not conclusive, for weak carcinogenic activity. Note: BADGE is a component in all BPA/ECH based liquid epoxy resins.

VI. ACCIDENTAL RELEASE MEASURES AND DISPOSAL CONSIDERATIONS

CONTAINMENT TECHNIQUES (REMOVAL OF IGNITION SOURCES, DIKING ETC): Dike and contain. Contain run- off and dispose of properly. Remove contaminated soil to remove contaminated trace residues.

CLEAN-UP PROCEDURES: Absorb with material such as sand, or polypropylene or polyethylene fiber products. Collect in suitable and properly label containers. Remove residual using hot soapy water. Residual can be removed with solvent. Solvents are not recommended for clean-up unless recommended exposure guidelines and safe handling practices for the specific solvent are followed. Consult appropriate solvent MSDS for handling instructions.

OTHER EMERGENCY ADVICE: Notify authorities if any exposures to the general public or environment occurs or is likely to occur.

WASTE DISPOSAL: If this product becomes a waste, it would not be a hazardous waste by RCRA criteria (40 CFR 261). Place in an appropriate disposal facility in compliance with local and federal regulations.

VII. HEALTH HAZARDS

ROUTES OF EXPOSURE: Eye Contact, Skin Contact, Ingestion, Inhalation, Skin Absorption, Exposure Standards, No standards established for the product. Maintain air contaminant concentrations in the workplace at the lowest feasible levels.

HEALTH HAZARDS: May be irritating to the eyes and skin. Contact with hot material can cause thermal burns. May cause skin sensitization.

TARGET ORGANS: Eye Skin Respiratory system

POTENTIAL HEALTH EFFECTS:

Inhalation- Not expected to be a relevant route of exposure, however, under conditions where exposure to vapors or mists is possible could cause respiratory tract infection. Skin- May be mildly irritating to the skin. Contact with hot material can cause thermal burns which may result in permanent damage. May cause skin sensitization. Eyes- May be mildly irritating to the eyes. Contact with hot material can cause thermal burns which may result in permanent damage or blindness. Ingestion- Not likely to be a relevant route of exposure.

SIGNS AND SYMPTOMS OF EXPOSURE (Possible Longer Term Effects): Repeated and/or prolonged exposure may cause skin sensitization, repeated exposures to low molecular weight epoxy resins of this type are not anticipated to cause any significant adverse effects. Many studies have been conducted to assess the potential carcinogenicity of diglycidyl ether of bisphenol A (DGEBPA). Although some weak evidence of carcinogenicity has been reported in animals, when all of the data are considered, the weight of the evidence does not show that DGEBPA is carcinogenic. Indeed, the most recent review of the available data be the International Agency for Research on Cancer (IARC) has concluded that DGEBPA isnot classified as a carcinogen. DGEBPA did not cause birth defects or other adverse effects on the fetus when pregnant rabbits were exposed by skin contact, the most likely route of exposure, or when pregnant rats or rabbits were exposed orally. In animal studies, this product has not been shown to interfere with reproduction.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Asthma, Chronic Respiratory Disease (e.g. Bronchitis, Emphysema), Eye disease, Skin disorders and Allergies.

CARCINOGENS UNDER OSHA, ACGIH, NTP, IARC, OTHER: N/A

VIII. FIRST AID

EYE CONTACT

Flush eyes with water. Rest eyes for 30 minutes. If redness, burning, blurred vision or swelling persist, consult a physician.

SKIN CONTACT

In case of contact with hot product, immediately flood the affected area with cold water. Wipe excess material from exposed area. Flush exposed skin with water and follow by washing with soap if available. Carefully remove clothing; if clothing is tuck to a burn area, do not pull it off, but cut around it. Cover burn area with clean material. Transport to nearest medical facility for additional treatment.

INHALATION

Move patient to fresh air and provide oxygen if breathing is difficult. Give artificial respiration if not breathing. Get medical attention.

INGESTION

Single dose oral toxicity is considered to be extremely low. No hazards anticipated from swallowing small amounts of incidental to normal handling operations.

IX. PERSONAL PROTECTION/EXPOSURE CONTROLS

EYE PROTECTION: Avoid contact with eyes. Wear chemical goggles if there is potential contact with eyes. Safety Spectacles.

HAND PROTECTION: Butyl; EVAL-Laminate.

RESPIRATORY PROTECTION: No respiratory protection is usually required under normal conditions of use.

PROTECTIVE CLOTHING: Wear appropriate respirator and protective clothing.

ENGINEERING CONTROLS: No specific controls needed.

IX. PERSONAL PROTECTION/EXPOSURE CONTROLS (CONTINUED)

WORK AND HYGIENIC PRACTICES: Provide readily accessible eye wash stations and safety showers. Wash at the end of each work shift and before eating, smoking or using the toilet. Promptly remove clothing that becomes contaminated. Use appropriate hand and skin lotions to protect the skin. Discard contaminated leather articles.

X. REGULATORY INFORMATION

US FEDERAL REGULATIONS

Resource Conservation and Recovery Act (RCRA): Not a hazardous waste under RCRA (40 CFR 261).

SARA Title III: Section 304 - CERCLA: Not listed.

SARA Title III: Section 313 Toxic Chemical List (TCL): This product does not contain a toxic chemical for routine annual 'Toxic Chemical Release Reporting' under Sec. 313 (40 CFR 372).

TSCA Section 8(b) - Inventory Status: Chemical components listed on TSCA Inventory.

TSCA Section 12(b) - Export Notification: This product contains chemical(s) which is (are) regulated by TSCA 12(b) Regulation and it is required that proper export notification shall be sent to the EPA prior to shipping out of the United States of America.
Bisphenol A Diglycidyl Ether
Oxraine, mono[(C-12-C-14-alkyoxy)methyl] derives.

INTERNATIONAL REGULATIONS

Canadian Inventory Status: All components included on the Domestic Substances List (DSL).

STATE REGULATIONS

PROPOSITION 65 SUBSTANCES (component(s) known to the State of California to cause cancer and/or reproductive toxicity and subject to warning and discharge requirements under the "Safe Drinking Water and Toxic Enforcement Act of 1986")
Epichlorhydrin (< 2 ppm) Carcinogenic.

NEW JERSEY TRADE SECRET REGISTRY NUMBER(S) The following is required composition information.
Phenol, 4, 4'-(-1methylethylidene)bis-, polymer with (chloromethyl)oxirane.

PENNSYLVANIA TRADE SECRET REGISTRY NUMBER(S) The following is required composition information. Not on the Pennsylvania Hazardous Substance List.
Phenol, 4, 4'-(-1methylethylidene)bis-, polymer with (chloromethyl)oxirane.

XI. TRANSPORT INFORMATION

DOT NON-BULK SHIPPING NAME
Not regulated.
DOT BULK SHIPPING NAME
Not regulated.
IMO SIPPING DATA
Not regulated.
ICAO/IATA SHIPPING DATA
Not regulated.
D.O.T CLASS: Not regulated.
HAZARDOUS INGREDIENT(S): Not regulated.
D.O.T. LABELS: Not regulated

CAUTION: Misuse of empty containers can be hazardous. Empty containers can be hazardous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers might cause fire, explosion or fumes from residues. Do not pressurize or expose to open flame or heat. Keep container closed and drum bungs in place.

The information on this data sheet represents our current data and best opinion as to the proper use and handling of this product under normal conditions. Any use of the product which is not in conformance with this data sheet or which involves using the product in combination with any other product or any other process is the responsibility of the user.

MATERIAL SAFETY DATA SHEET

E-BOND EPOXIES, INC.
P.O. BOX 23069 (501 N.E. 33 STREET)
PH: (954) 566-6555

FT. LAUDERDALE, FLORIDA 33307
EMERGENCY PHONE: (800) 255-3924

PRODUCT NAME: E-BOND G-100 EPOXY GROUT COMP B (HARDENER) **DATE: 09/08/05**

I. INGREDIENT

	C.A.S NO.	OSHA – ACGIH TLV - TWA ppm	TLV - TWA mg/m3	STEL ppm	STEL mg/m3	Percent
Proprietary Blend of Amiodoamines, Aliphatic	Trade Secret	0.5	2.3	N/E	N/E	>45.0
and their Adducts		N/E	5.0	N/E	N/E	< 1.0

* N/E = Not Established

II. EMERGENCY OVERVIEW

HMIS HEALTH 3 FLAMMABILITY 1 REACTIVITY 0

PHYSICAL FORM: Mobile liquid
COLOR: Gray
ODOR: Irritating
HAZARDS: Harmful if in contact with skin. Harmful if swallowed. Corrosive to eyes. Corrosive to skin. Severe eye irritant. Sever respiratory tract irritant. Severe skin irritant. May cause respiratory sensitization. May cause skin sensitization.

EXTINGUISHING MEDIA: Ignition will give rise to a Class B fire. In case of large fire use: alcohol foam, water spray. In case of small fire use: carbon dioxide (CO_2), dry chemical, dry sand or limestone.

III. PHYSICAL DATA

Boiling Point:.....>350°F/(176°C)
Vapor Pressure:.....< 1.06 MMHG
Vapor Density:.....N/A
Evaporation Rate:.....< 1 BUDAC = 1
Solubility in Water.....Slight (0.1-1%)
Specific Gravity:..... < 1.54 WATER=1
Percent Volatile:.....NEGLIG.
Volatile Organic Compounds:.....N/A
Voc Less H2O & Exempt Solvents:.....N/A
PH:.....Alkaline
Melting Point.....N/A
Appearance and Odor.....Clear Amber, Ammoniacal, Amine odor

IV. FIRE & EXPLOSION DATA

Flash Point:.....>200 °F/93°C
Flammable Limits - LEL:.....N/D
Flammable Limits - UEL:.....N/D
Autoignition Temperature:.....N/D
Extinguishing Media

Ignition will give rise to a Class B fire. In case of large fire use: water spray, alcohol foam. In case of small fire use: carbon dioxide (CO2), dry chemical, dry sand or limestone.

SPECIAL FIRE FIGHTING PROCEDURES

Ignition will give rise to a Class B fire. In case of large fire use: water spray, alcohol foam. In case of small fire use: carbon dioxide (CO2), dry chemical, dry sand or limestone.

UNUSUAL FIRE AND EXPLOSION HAZARDS

May generate toxic or irritating combustion products.
Contact of liquid with skin must be prevented.
Sudden reaction and fire may result if product is mixed with an oxidizing agent.

May generate carbon monoxide gas. May generate toxic nitrogen oxide gases. May generate ammonia gas. Personnel in vicinity and downwind should be evacuated.

V. STABILITY/REACTIVITY/TOXICOLOGICAL PROPERTIES

CHEMICAL STABILITY: Stable

CONDITIONS TO AVOID (if unstable): Not applicable

INCOMPATIBILITY (Materials to Avoid): Mineral acids (i.e. sulfuric, phosphoric, etc.). Organic acids (i.e. acetic acid, citric acid etc.). Oxidizing Agents (i.e. perchlorates, nitrates etc.). Reactive metals (i.e. sodium, calcium, zinc etc.). Sodium or Calcium Hypochlorite. Product slowly corrodes copper, aluminum, zinc and galvanized surfaces. Reaction with peroxides may result in violent decomposition of peroxide possibly creating an explosion. Materials reactive WIth hydroxyl Compounds. A reaction accompanied by large heat release occurs when the product is mixed with acids. Heat generated may be sufficient to cause vigorous boiling creating a hazard due to splashing or splattering of hot material.

HAZARDOUS DECOMPOSITION PRODUCTS (from burning, heating, or reaction with other materials). Nitrogen oxide can react with water vapors to form corrosive nitric acid (TLV=2 ppm). Carbon Monoxide in a fire. Carbon Dioxide in a fire. Ammonia when heated. Nitrogen Oxides in a fire. Irritating and toxic fumes at elevated temperatures. Nitric acid in a fire. Aldehydes. The oxides of nitrogen gases (except nitrous oxide) emitted on decomposition are highly toxic.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID (if polymerization may occur):Not applicable

ACUTE ORAL TOXICITY (LD50, RAT): >1080.00 mg/kg (Estimate)

ACUTE DERMAL TOXICITY (LD50, RABBIT): >1090.00 mg/kg

ACUTE INHALATION TOXICITY (LC50, RAT): >10.0 mg/L / 1 hr (No Deaths) (Estimate)

V. STABILITY/REACTIVITY/TOXICOLOGICAL PROPERTIES (CONTINUED)

IRRITATION EFFECTS DATA: Corrosive to the eyes of a rabbit. Severe irritant to the skin of a rabbit.

CHRONIC/SUBCHRONIC DATA: Component has caused skin and respiratory sensitization in humans.

OTHER DATA: Toxicity data from similar products. Industrial chemicals such as this material with acute toxicity values shown above and whose vapors or mists are not likely to be encountered by humans when used in any reasonably foreseeable manner would not require a toxic label according to U.S. domestic and international transport regulations.

OTHER ACUTE EFFECTS: No Data.

IRRITATION EFFECTS DATA: Corrosive to the skin of a rabbit.

VI. ACCIDENTAL RELEASE MEASURES AND DISPOSAL CONSIDERATIONS

CONTAINMENT TECHNIQUES (REMOVAL OF IGNITION SOURCES, DIKING ETC): Stop the leak, if possible. Ventilate the space involved. Reduce vapor spreading with a water spray. Shut off or remove all sources. Construct a dike to prevent spreading (includes molten liquids until they freeze).

CLEAN-UP PROCEDURES: If recovery is not feasible, admix with dry soil, Sand or non-reactive absorbent and place in an appropriate chemical waste container. Transfer to containers by suction, preparatory for later disposal. Flush area with water spray. Clean-up personnel must be equipped with self-contained breathing apparatus and butyl rubber protective clothing. For large spills, recover spilled material with a vacuum truck.

OTHER EMERGENCY ADVICE: Open enclosed spaces to outside atmosphere.
Wear protective clothing, boots, gloves, and eye protection.

WASTE DISPOSAL: Comply with all Federal, state and Local Regulations.

VII. HEALTH HAZARDS

ROUTES OF EXPOSURE: Eye Contact, Skin Contact, Ingestion, Inhalation, Skin Absorption, Exposure Standards, No standards established for the product. Maintain air contaminant concentrations in the workplace at the lowest feasible levels.

HEALTH HAZARDS: Corrosive to eyes. Corrosive to respiratory system. Corrosive to skin. Severe eye irritant. Severe respiratory tract irritant. Severe skin irritant. May cause skin sensitization.

TARGET ORGANS: Eye Skin Respiratory system
SIGNS AND SYMPTOMS OF EXPOSURE (Acute effects)
Product vapor in low concentrations can cause lacrimation, conjunctivitis and corneal edema when absorbed into the tissue of the eye from the atmosphere. Corneal edema may give rise to a perception of "blue haze"or "fog" around lights. The effect is transient and has no known residual effect. Burns of the eye may cause blindness. Contact with the skin may cause dryness (defatting), itching and/or rash. Contact of undiluted product with the eyes or skin quickly causes severe irritation and pain and may cause burns, necrosis and permanent injury. Inhalation of vapors may severely damage contacted tissue and produce scarring. Inhalation of aerosols and mists may severely damage contacted tissue and produce scarring. Risk of exposure to hazardous concentrations of vapor under normal working conditions in a well-ventilated space is minimal. However, conditions such as spraying, or sudden release of hot liquid, which generate an aerosol, mists or fog should be avoided. Product is absorbed through the skin and may cause nausea, headache and general discomfort.

VII. HEALTH HAZARDS (CONTINUED)

SIGNS AND SYMPTOMS OF EXPOSURE (Possible Longer Term Effects: Repeated and/or prolonged exposure may cause allergic reaction/sensitization. Repeated and/or prolonged exposures may result in: adverse respiratory effects (such as cough, tightness of chest or shortness of breath), adverse eye effects (such as conjunctivitis or corneal damage), adverse skin effects (such as defatting, rash, or irritation), adverse skin effects (such as rash, irritation or corrosion). Effects from inhalation of vapors may be delayed. Dryness of nasal passages may be experienced when material is inhaled over a long period of time. Repeated and/or prolonged exposure to low concentrations of vapor may cause: sore throat which are transient.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Asthma, Chronic Respiratory Disease (e.g. Bronchitis, Emphysema), Eye disease, Skin disorders and Allergies.

CARCINOGENS UNDER OSHA, ACGIH, NTP, IARC, OTHER: This product contains no carcinogens in concentrations of 0.1 percent or greater.

VIII. FIRST AID

EYE CONTACT

Hold eyelids apart and immediately flush eyes with plenty of water for at least 15 minutes. Seek medical advice.

SKIN CONTACT

Remove contaminated clothing and shoes. Remove product and immediately flush affected area with water for at least 15 minutes. Destroy contaminated leather apparel. Cover the affected area with a sterile dressing or clean sheeting and transport for medical care. Do not apply greases or ointments. Control shock, if present. Launder contaminated clothing prior to reuse.

INHALATION

Move patient to fresh air. If breathing has stopped or is labored give assisted respiration (e.g. mouth-to mouth). Supplemental oxygen may be indicated. Seek medical advice. Prevent aspiration of vomit. Turn victim's head to the side.

INGESTION

In the event of ingestion, administer 3-4 glasses of milk or water. Do not induce vomiting. Seek medical advice.

IX. PERSONAL PROTECTION/EXPOSURE CONTROLS

EYE PROTECTION: Full-face shield with goggles underneath.

HAND PROTECTION: Neoprene rubber gloves. Impermeable gloves. Cuffed Butyl rubber gloves. Nitrile rubber gloves. The breakthrough time of the selected glove(s) must be greater than the intended use period.

RESPIRATORY PROTECTION: Not required under normal conditions in a well-ventilated workplace. An organic vapor respirator national institute for occupational safety and health (NIOSH) approved for organic vapors is recommended under emergency conditions.

PROTECTIVE CLOTHING: Impervious clothing. Slicker suit. Rubber boots. Full rubber suit (rain gear), butyl or latex protective clothing.

ENGINEERING CONTROLS: No specific controls needed.

IX. PERSONAL PROTECTION/EXPOSURE CONTROLS (CONTINUED)

WORK AND HYGIENIC PRACTICES: Provide readily accessible eye wash stations and safety showers. Wash at the end of each work shift and before eating, smoking or using the toilet. Promptly remove clothing that becomes contaminated. Use appropriate hand and skin lotions to protect the skin. Discard contaminated leather articles.

X. REGULATORY INFORMATION

US FEDERAL REGULATIONS

TOXIC SUBSTANCES CONTROL ACT (TSCA)-
All components are included in the EPA Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

TOXIC SUBSTANCE CONTROL ACT (TSCA) 12(b) COMPONENT(S)
None

OSHA Hazard Communication Standard (29CFR1910.1200) hazard class(es)
Corrosive. Sensitizer.

EPA SARA Title III Section 312 (40CFR370) hazard class
Immediate Health Hazard. Delayed Health Hazard.

EPA SARA Title III Section 313 (40CFR372) toxic chemicals above "de minimis" level are
None

STATE REGULATIONS

PROPOSITION 65 SUBSTANCES (component(s) known to the State of California to cause cancer and/or reproductive toxicity and subject to warning and discharge requirements under the "Safe Drinking Water and Toxic Enforcement Act of 1986")
Epichlorohydrin (< 2 ppm) Carcinogenic.

NEW JERSEY TRADE SECRET REGISTRY NUMBER(S)
Phenol, 4, 4'-(-1methylethylidene)bis-, polymer with (chloromethyl)oxirane
Diethylenetriamine; Tetraethylenepentamine

PENNSYLVANIA TRADE SECRET REGISTRY NUMBER(S)
Phenol, 4, 4'-(-1methylethylidene)bis-, polymer with (chloromethyl)oxirane
Diethylenetriamine; Tetraethylenepentamine

INTERNATIONAL REGULATIONS- CANADA

DSL
Included on inventory.

WHMIS HAZARD CLASSIFICATION
Class D Division 2A, Class D Division 2B, Class E Corrosive.

WHMIS INGREDIENT DISCLOSURE LIST
Diethylenetriamine (DETA)
TETRAETHYLENEPENTAMINE (TEPA)
Phenol,4,4'-(1-methylethylidene)BIS-

WHMIS TRADE SECRET REGISTRY NUMBER(S)
None

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.
None

WHMIS SYMBOLS
Test tube/hand, Stylized T

MSDS: E-BOND G-100 Epoxy Grout Comp B Hardener **PAGE 6**

XI. TRANSPORT INFORMATION

DOT NON-BULK SHIPPING NAME
Corrosive, Liquid, Class 8, UN1760, PG III
DOT BULK SHIPPING NAME
Corrosive, Liquid, Class 8, UN1760, PG III
IMO SHIPPING DATA
Refer to Bill of Lading.
ICAO/IATA SHIPPING DATA
Corrosive, Liquid, Class 8, UN1760, PG III
D.O.T CLASS: Corrosive Liquid, N.O.S. UN/NA NUMBER 1760
HAZARDOUS INGREDIENT(S): Corrosive Liquid, Amines
D.O.T. LABELS: CORROSIVE, N.O.S.

CAUTION: Misuse of empty containers can be hazardous. Empty containers can be hazardous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers might cause fire, explosion or fumes from residues. Do not pressurize or expose to open flame or heat. Keep container closed and drum bungs in place.

The information on this data sheet represents our current data and best opinion as to the proper use and handling of this product under normal conditions. Any use of the product which is not in conformance with this data sheet or which involves using the product in combination with any other product or any other process is the responsibility of the user.

8.2 3M Loop Sealant

3M Canada Company
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Material Safety Data Sheet
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1 Product Identification

Tradename:
3M DETECTOR LOOP SEALANT BLACK 5000
Product ID:
78-8110-9503-9 78-8016-9813-1 78-8110-9504-7
Intended Use of Product:
Sealant
Division:
FOOD SERVICES TRADE DEPARTMENT

2 Composition/Information on Ingredients

Ingredient Name	CAS Number	Percentage
URETHANE PREPOLYMER	9057-91-4	25 - 35
TALC	14807-96-6	20 - 30
POLYSTYRENE	9003-53-6	15 - 25
1-METHOXY-2-PROPYL ACETATE	108-65-6	15 - 25
DIMETHYL SILOXANE, REACTION PRODUCT WITH SILICA	67762-90-7	1 - 5
2-METHOXY-1-PROPYL ACETATE	70657-70-4	0.5 - 1.0
TOLUENE 2,4-DIISOCYANATE	584-84-9	0.1 - 0.5
CARBON BLACK	1333-86-4	0.1 - 0.5
TOLUENE 2,6-DIISOCYANATE	91-08-7	0.1 - 0.2

1-METHOXY-2-PROPANOL	107-98-2	0.1 - 0.2

NOTE:
Each percentage is expressed as the ratio of the weight of the ingredient to the weight of the controlled product.

3 Hazards Identification

Critical Hazards:
Combustible liquid and vapour.
Moderate Eye Irritation: Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.
Allergic Skin
Reaction (non-photo induced): Signs/symptoms may include redness, swelling, blistering, and itching.
Allergic Respiratory Reaction:
Signs/symptoms can include difficulty breathing, wheezing, cough, and tightness of chest.
WARNING: Contains a chemical which can
cause cancer. (584-84-9) (NTP anticipated human carcinogen, IARC possible human carcinogen 2B, Calif. Proposition 65)
WARNING:
Contains a chemical which can cause cancer (1333-86-4) (IARC possible human carcinogen 2B)
WARNING: Contains a chemical which
can cause cancer. (91-08-7) (NTP anticipated human carcinogen, IARC

possible human carcinogen 2B)
TALC (14807-96-6) has been shown to cause fibrosis of the lungs.
See Sections 7 and 11 for further information.

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4 First Aid Measures

Instructions for Eye Contact:
Immediately flush eyes with large amounts of water for at least 15 minutes. Get immediate medical attention.

Instructions for Skin Contact:
Immediately flush skin with large amounts of water. Remove contaminated clothing. If irritation persists, call a physician. Wash contaminated clothing before reuse.

Instructions for Inhalation:
Remove person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, get immediate medical attention.

Instructions for Ingestion:
Drink two glasses of water. Call a physician.

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5 Fire Fighting Measures

Flash point:	Approximately42.8 C
Lower Explosive Limit (%):	1 %
Upper Explosive Limit (%):	7 %
Autoignition temperature:	Not Available

Suitable Extinguishing Media:
Water spray; Carbon Dioxide; Dry chemical; Foam;

Exposure Hazards during Fire:
No data available.

Combustion Products from Fire:
Carbon monoxide and carbon dioxide; Oxides of nitrogen; Hydrogen Cyanide; Aldehydes; Isocyanates;

Fire Fighting Procedures:
Wear full protective clothing, including helmet, self-contained, positive pressure or pressure demand breathing apparatus, bunker coat and pants, bands around arms, waist and legs, face mask, and protective covering for exposed areas of the head.

NFPA: Health	3
NFPA: Fire	2
NFPA: Reactivity	1
NFPA: Unusual Reaction Hazard	reacts with water

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6 Accidental Release Measures

Personal Precautions:
Refer to other sections of this MSDS for information regarding physical and health hazards, respiratory protection, ventilation, and personal protective equipment.

Spill Response:
Ventilate the area with fresh air. Remove all ignition sources such

as flames, smoking materials, and electrical spark sources. Use only non-sparking tools. Evacuate unprotected and untrained personnel from hazard area. The spill should be cleaned up by qualified personnel. Collect as much of the spilled material as possible using non-sparking tools. Clean up residue with an appropriate organic solvent. Read and follow safety precautions on the solvent label and MSDS. Place in an approved metal container. Seal the container. Avoid contact with water.

Methods for Disposal:

Incinerate in a permitted hazardous waste incinerator.

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7 Handling and Storage

Storage Requirements:

Store in a cool place. Avoid contact with water.

Incompatible Materials:

Store out of direct sunlight. Keep away from aluminum and zinc. Store away from acids; Amines; Alcohols; Water;

Ventilation:

Keep container in well-ventilated area.

Fire Prevention:

No smoking while handling this material.

Explosion Prevention:

Keep away from heat, sparks, open flame, pilot lights and other sources of ignition. Prevent all sources of ignition. Combustible liquid and vapour.

Use Instructions:

Contents may be under pressure, open carefully. Keep container tightly closed. Do not pierce or burn container, even after use.

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8 Exposure Controls/Personal Protection

Personal Protection

Eye Protection:

The following should be worn alone or in combination, as appropriate, to prevent eye contact: Safety glasses with side shields

Hand Protection:

The following glove material(s) are recommended: butyl rubber;

Skin Protection:

Avoid skin contact.

Respiratory Protection:

Avoid breathing of vapours. Select one of the following approved respirators based on airborne concentration of contaminants and in accordance with regulations: half-mask organic vapour respirator;

When applying 3M Brand Detector Loop Sealant 5000 outdoors where air movement is unrestricted, there is little risk of user overexposure and, therefore, no need to use a respirator. Always

follow product directions.
Ingestion (Prevention):
Do not eat, drink or smoke when using this product. Wash exposed areas thoroughly with soap and water.
Recommended Ventilation:

Use with adequate dilution ventilation. If exhaust ventilation is not adequate, use appropriate respiratory protection.

Ingredient Exposure Data

URETHANE PREPOLYMER (9057-91-4)
Specific Ingredient Data: Not Available.
LD50 (rat, oral)
: No data available.
LC50 (rat, inhalation/4 hours)
: No data available.
Exposure Limits
: No data available.
TALC (14807-96-6)
LD50 (rat, oral)
: No data available.
LC50 (rat, inhalation/4 hours)
: No data available.
Exposure Limits: ACGIH: TWA 2 mg/m3 (Respirable) (Table A4)
CMRG: TWA 0.5 mg/m3 as respirable dust (specific form)
POLYSTYRENE (9003-53-6)
LD50 (rat, oral)
: No data available.
LC50 (rat, inhalation/4 hours)
: No data available.
Exposure Limits
: No data available.
1-METHOXY-2-PROPYL ACETATE (108-65-6)
LD50 (rat, oral): 8532 mg/kg
LC50 (rat, inhalation/4 hours)
: No data available.
Exposure Limits: AIHA: TWA 100 ppm
AIHA: TWA 541 mg/m3
CMRG: TWA 100 ppm
DIMETHYL SILOXANE, REACTION PRODUCT WITH SILICA (67762-90-7)
Specific Ingredient Data: LD50 (rat, dermal): >16 ml/kg
LD50 (rat, oral): >64 g/kg
LD50 (dermal, rabbit): >16 g/kg
LC50 (rat, inhalation/4 hours): 315 -708 mg/m3
Exposure Limits: CMRG: CEIL 5 mg/m3
2-METHOXY-1-PROPYL ACETATE (70657-70-4)
Specific Ingredient Data: No data available.
LD50 (rat, oral)
: No data available.
LC50 (rat, inhalation/4 hours)
: No data available.
Exposure Limits

: No data available.
TOLUENE 2,4-DIISOCYANATE (584-84-9)
LD50 (rat, oral): 5800 mg/kg
LC50 (rat, inhalation/4 hours): 14 ppm
Exposure Limits: ACGIH: TWA 0.005 ppm (Table A4)
ACGIH: TWA 0.036 mg/m3 (Table A4)
ACGIH: STEL 0.02 ppm (Table A4)
ACGIH: STEL 0.14 mg/m3 (Table A4)
CARBON BLACK (1333-86-4)
LD50 (rat, oral): >15400 mg/kg
LC50 (rat, inhalation/4 hours): 6750 mg/m3
Exposure Limits: ACGIH: TWA 3.5 mg/m3 (Table A4)
CMRG: TWA 0.5 mg/m3
TOLUENE 2,6-DIISOCYANATE (91-08-7)
LD50 (rat, oral)
: No data available.
LC50 (rat, inhalation/4 hours)
: No data available.
Exposure Limits: 3M: TWA 0.005 ppm Category: FREE ISOCYANATES
3M: STEL 0.02 ppm Category: FREE ISOCYANATES
1-METHOXY-2-PROPANOL (107-98-2)
LD50 (rat, oral): 6600 mg/kg
LD50 (dermal, rabbit): 13 g/kg
LC50 (rat, inhalation/4 hours): 15,000 ppm
Exposure Limits: ACGIH: TWA 150 ppm
ACGIH: TWA 553 mg/m3
ACGIH: STEL 100 ppm
ACGIH: STEL 369 mg/m3

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9 Physical and Chemical Properties

Physical form,Color,Odour:	Caulk; Black; mild odour;
Odour Threshold:	No data available.
pH:	Not applicable
Boiling point/boiling range:	156.1 C
Melting point/melting range:	Not Available
Vapour pressure:	2 mmHg
Water Solubility:	Nil
Specific gravity:	1.22 Water=1
Vapour density:	4.60 Air=1
Volatile organic compounds:	248 gms/liter
Evaporation rate:	0.21 BuOAc=1
Viscosity:	25000 centipoise
Percent Volatile:	20 %

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10 Stability and Reactivity

Conditions to Avoid:
Store out of direct sunlight.
Materials to Avoid:
Keep away from aluminum and zinc. Store away from acids; Amines; Alcohols; Water;
Hazardous Decomposition:
Carbon monoxide and carbon dioxide; Oxides of nitrogen; Hydrogen Cyanide; Aldehydes; Isocyanates;
Stability and Reactivity:
Stable. Hazardous polymerization will not occur.

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11 Toxicological Information

Effects from Eye Contact:
Moderate Eye Irritation: Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.
Effects from Skin Contact:
Allergic Skin Reaction (non-photo induced): Signs/symptoms may include redness, swelling, blistering, and itching.
Mild Skin
Irritation (after prolonged or repeated contact): signs/symptoms can include redness, swelling, and itching.
Effects from Inhalation:
Allergic Respiratory Reaction: Signs/symptoms can include difficulty breathing, wheezing, cough, and tightness of chest.

Nervous System Effects: signs/symptoms can include emotional changes, lack of coordination, tremors and sensory loss.
Upper
Respiratory Tract Irritation: Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain.
Prolonged or repeated exposure may cause:
Kidney Effects: signs/symptoms can include reduced urine volume, blood in urine and back pain.
Liver Effects:
signs/symptoms can include yellow skin(jaundice) and tenderness of upper abdomen.
Effects from Ingestion:
Ingestion is not a likely route of exposure to this product.
Gastrointestinal Irritation: Signs/symptoms may include abdominal pain, nausea, diarrhea and vomiting.
Central Nervous System
Depression: signs/symptoms can include headache, dizziness,

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drowsiness, muscular weakness, incoordination, slowed reaction time, fatigue, blurred vision, slurred speech, giddiness, tremors and convulsions.
Sensitization Information:
Allergic Skin Reaction (non-photo induced): Signs/symptoms may include redness, swelling, blistering, and itching.

Allergic
Respiratory Reaction: Signs/symptoms can include difficulty breathing, wheezing, cough, and tightness of chest.

Carcinogenicity:
WARNING: Contains a chemical which can cause cancer. (584-84-9) (NTP anticipated human carcinogen, IARC possible human carcinogen 2B, Calif. Proposition 65)
WARNING: Contains a chemical which can cause cancer (1333-86-4) (IARC possible human carcinogen 2B)

WARNING: Contains a chemical which can cause cancer. (91-08-7) (NTP anticipated human carcinogen, IARC possible human carcinogen 2B)

Mutagenicity:
No data available.

Reproductive Effects:
WHILE THE FOLLOWING EFFECTS ARE ASSOCIATED WITH ONE OR MORE OF THE INDIVIDUAL INGREDIENTS IN THIS PRODUCT AND ARE REQUIRED TO BE INCLUDED ON THE MSDS BY THE U.S. OSHA HAZARD COMMUNICATION STANDARD. THEY ARE NOT EXPECTED EFFECTS DURING FORESEEABLE USE OF THIS PRODUCT.

2-METHOXY-1-PROPYL ACETATE (70657-70-4) is a potential reproductive hazard causing vertebral anomalies, skeletal defects, cleft palate, heart effects and kidney effects via inhalation exposure in laboratory animal studies.

Component Based Information:
TALC (14807-96-6) has been shown to cause fibrosis of the lungs.

Product Based Information:
No data available.

12 Ecological Information

Environmental Data:

Ecotoxicity Data:
No data available.

Ecofate Data:

Other Effects and Information:
Since regulations vary, consult applicable regulations or authorities before disposal.

13 Disposal Considerations

Product as Sold:
No data available.

Product Packaging:
No data available.

Special Instructions:
Since regulations vary, consult applicable regulations or authorities before disposal.

14 Transportation Information

Transportation of Dangerous Goods

TDG Classification:	Non-Regulated: TDGR Section 1.33 Regulated by Air and Ocean Limited Quantity;
Proper Shipping Name:	RESIN SOLUTION
Class/Division:	3
UN Number:	UN1866
Packing Group:	III

International Dangerous Goods Classification

15 Regulatory Information

WHMIS Classification:	B3, D2A, D2B

NOTE:
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

Product Certifications:
The product on this MSDS, or all its components, is included on the following countries' chemical inventories, as noted:
DSL - Domestic Substances List (Canada)
TSCA - Toxic Substances Control Act (USA)
EINECS -
European Inventory of Existing Commercial Chemical Substances
AICS - Australian Inventory of Chemical Substances

16 Other Information

Reason for Reissue:
MSDS initial issue

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