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A	5121941	Release to rev A	Richard Keightley	01/24/2017	Dat Nguy
B	5124824	Sensor configuration and data review added for both Local Mode and Lynx	Richard Keightley	5/04/17	Andy Strother
C	5126326	Changed "last slot" wording, top of p. 2	Richard Keightley	6/07/17	Andy Strother
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Lynx Smart Satellite Sensor Kit

Installation and User Guide



The Lynx Smart Satellite Sensor (LSSS) Kit receives data from flow, temperature, and pressure sensors, as well as switches and rain buckets. The data is stored in the satellite and relayed to the Lynx computer. User-defined alarms and responses can be configured in Lynx when operating in Central Mode, or locally when in Local Mode.

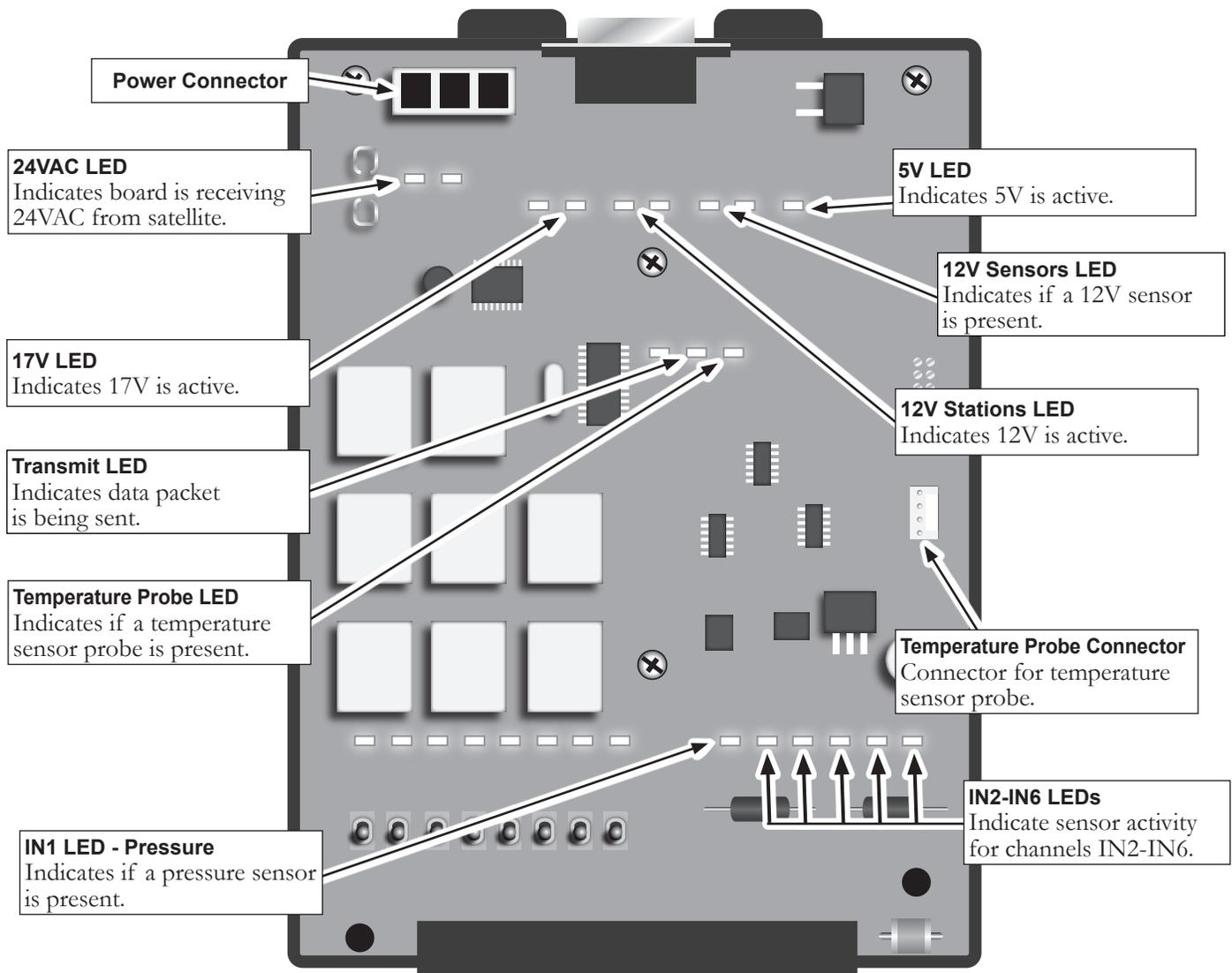
- Sensor data is stored in the satellite for 12 hours and transmitted back to Lynx every 2 hours.
- Current sensor information and alarm status can be viewed in the satellite's faceplate.
- Central-based or stand-alone alarm responses can be configured for any sensor input.
- When alarms are configured, Lynx will monitor the sensor-kit equipped satellite at the polling interval. The Sensor Dashboard Utility will monitor sensor status every 15 seconds.



A handful of satellites will need a firmware update to take advantage of the Lynx Smart Satellite Sensor Kit. Please see p. 7 for firmware version instructions.

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Sensor Input Board Overview



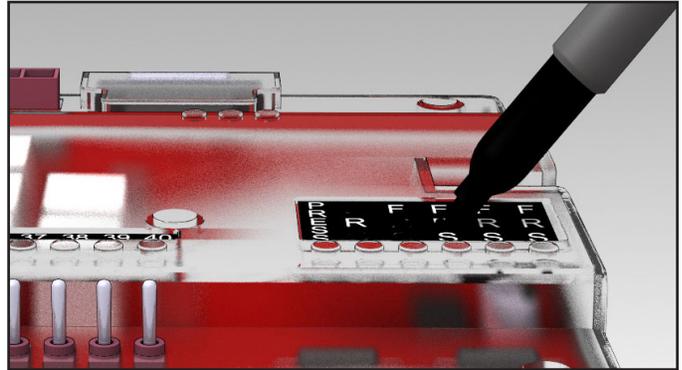
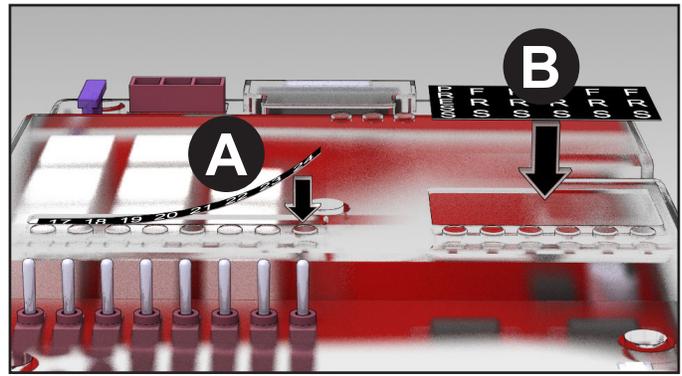
LSSS Preparation

The sensor input board must be installed in the *next available* slot in the satellite. For example, with a 16 station satellite, the sensor input board must be located at the 17-32 station board location. If all slots are filled, the last station output board must be removed.

-  The LSSS board has 8 output stations on it. If your satellite was originally a 64-station satellite, you are replacing the last 8 stations with sensor inputs.
-  The empty slot might end up being on the back side of the controller. If that is the case, purchasing additional hardware might be necessary. Talk to your authorized Toro distributor.
-  If there are multiple empty slots available, the sensor input board must be installed in the *next available slot* after the station output boards.

Toro supplies a sticker to label the final 8 stations in your system. For example, if your satellite has one station output board (16 stations), the sensor board would include stations 17 through 24 and the 17 through 24 station label should be applied.

1. Peel appropriate station number sticker **A** from adhesive backing. Apply to station count area.
2. Apply the sensor sticker **B** to the sensor sticker area.



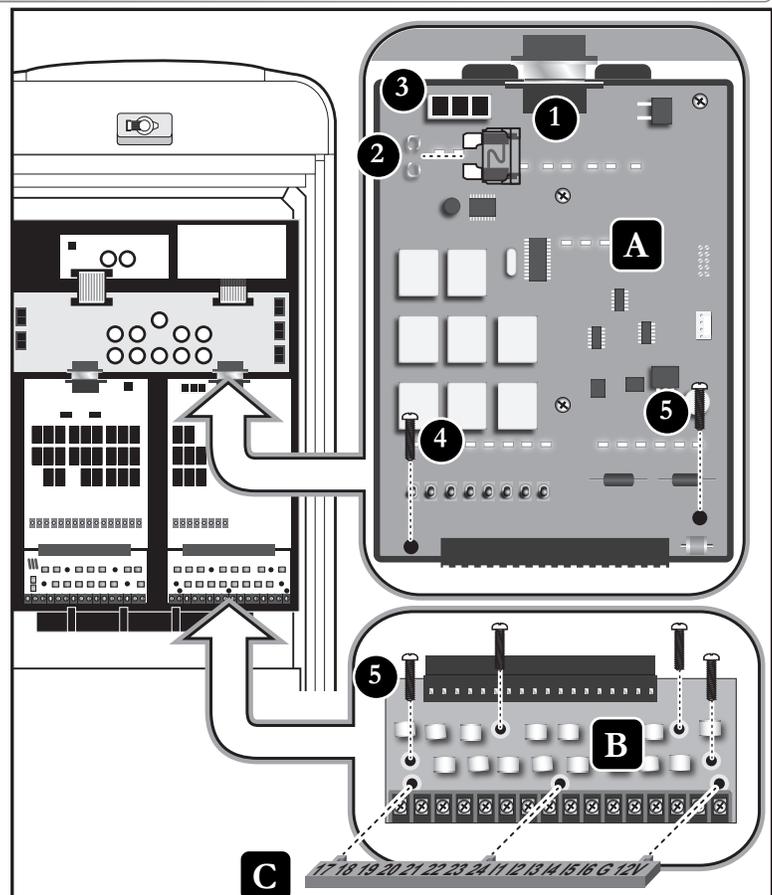
3. Use a black marker to “black out” the sensors that are NOT part of the system.

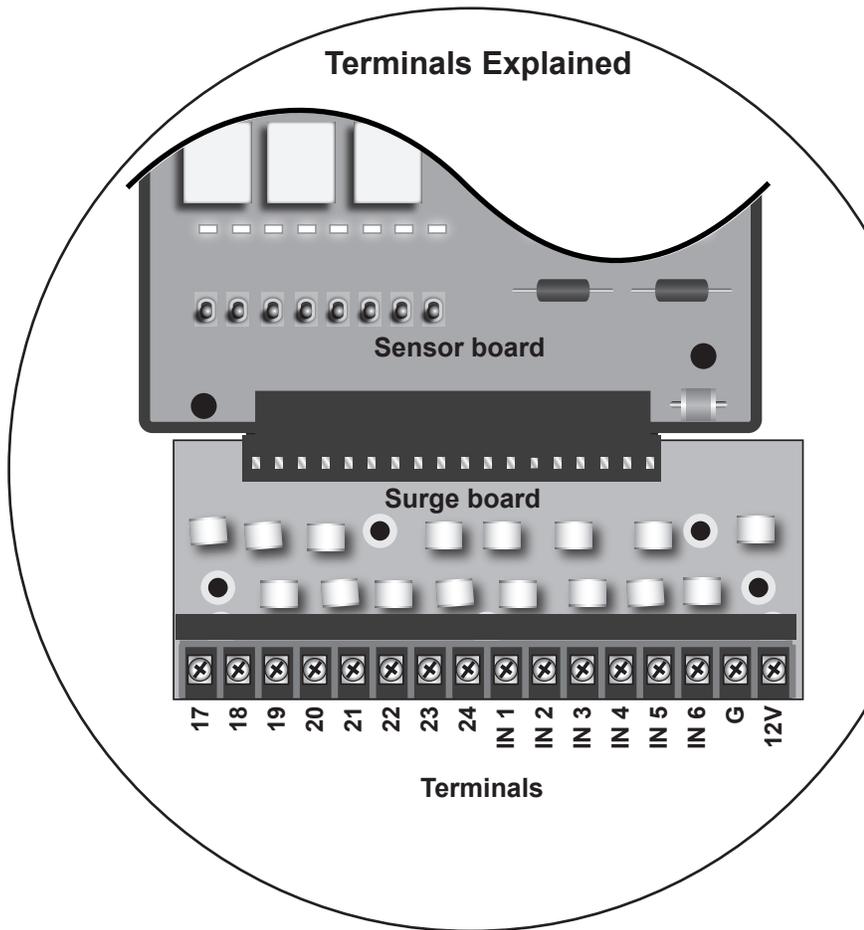
Sensor Input Board Installation

1. Remove the front panel door and power down the satellite controller.
2. Locate the next available output board slot in which to install the sensor input board. If the satellite is utilizing all output board slots, remove the last station output board and use that location.
3. Insert the sensor input board **A** so that the top port **1** lines up with the distribution board port.
4. Install the fuse **2** then connect power to power connector **3**.
5. Secure with the included screws **4**.
6. If a Surge Board is not already available, install the provided Surge board **B**. Secure with four retaining screws **5**.
7. Depending on the 8 stations from the LSSS board, insert the appropriately labelled plastic tab bar **C** into the holes in the surge board **B**.

 For an explanation of the text on the plastic tab bar, see table and illustration next page.

8. Restore power to the satellite controller. The satellite should detect and display the correct number of stations and 7 sensor inputs. Note the station count; this value will be used to update the satellite station count in Lynx.





Surge Board Outputs

Label	Description
17-24	Station outputs. (These numbers can vary.)
IN 1	Pressure Sensor Input
IN 2	Flow, Rain, or Status Sensor Input
IN 3	Flow, Rain, or Status Sensor Input
IN 4	Flow, Rain, or Status Sensor Input
IN 5	Flow, Rain, or Status Sensor Input
IN 6	Flow, Rain, or Status Sensor Input
G	12 V Ground
12V	12 V DC Output

Sensor Installation

The Lynx Smart Satellite sensor (LSSS) input board can accommodate a wide variety of sensors: pressure, flow, rain, status, and temperature.

While we strive to support all sensors, documenting the installation procedure for every available sensor is not possible. If the below installation steps do not work, consult the documentation that shipped with your sensor.

These instructions assume the specified sensor is already installed in your irrigation system and cables already run to the controller.



For all sensor installation procedures, turn off or remove power from the controller.

Pressure Sensor

Toro sells a pressure sensor kit (part number PRESS200-SEN-KIT), composed of a 6' long sensor cable and a pressure sensor.

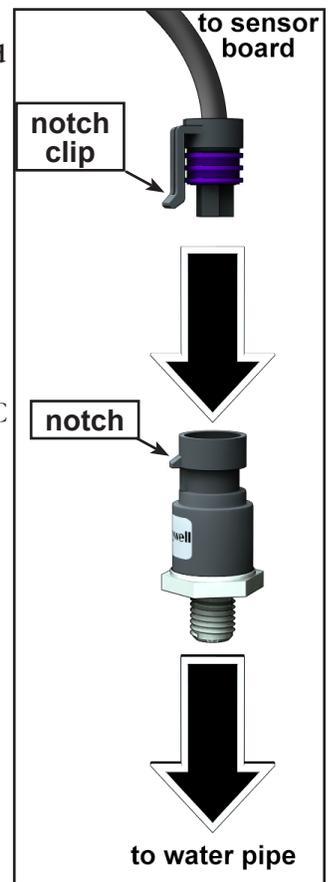
Steps

- At the LSSS board, secure the pressure sensor's **black lead to screw IN 1** and **white lead to screw 12V** (see **Terminals Explained** illustration above).
- At the sensor, insert the wire plug into the adapter of

the pressure sensor. Be sure **the notch is aligned with the notch clip** (see illustration, right).



The pressure sensor ships with a six foot long wire. If a longer wire is needed, Toro specifies Belden part #8780, a spool of 16 AWG stranded tinned copper conductors, PVC insulation, twisted pair, tinned copper spiral wrapped shield, PVC jacket.

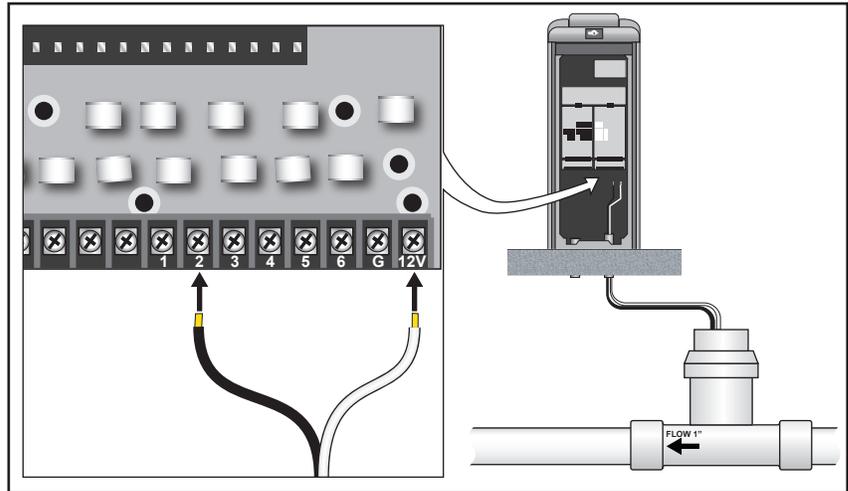


Flow / Rain Bucket / Status (Normally Open / Normally Closed) Sensor

Secure the flow / rain bucket / status sensor's black lead to screw IN 2 (or any terminal input thru IN 6) and red or white lead to terminal input 12V (see illustration).



DO NOT ATTACH A LEAD TO THE G (ground) TERMINAL. That will short the power to the controller.



The Toro temperature sensor will be available in late 2017.

Temperature Sensor

A temperature sensor must be connected to the Temperature Probe Connection port. See **Sensor Input Board Overview** on page 1 for port location.

Sensor Configuration - Local Mode

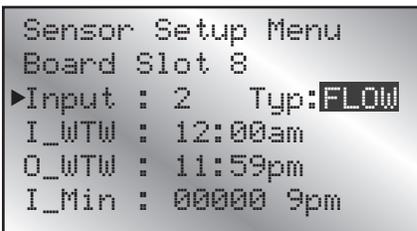


Sensor configuration can either be done at the satellite in Local Mode or at a Central computer running Lynx. If communication is established between a satellite and a Lynx system, the Lynx system will overwrite all locally defined sensor configuration information. Meaning, if operating a Lynx system, the sensors must be configured with Lynx.

Procedure

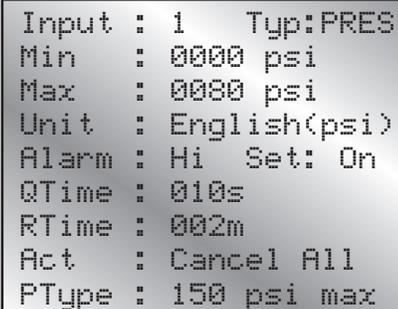
1. Return power to the controller.
2. The controller can automatically tell if a pressure sensor and/or a temperature sensor is installed. For flow, rain, and status sensors, however, we need to tell the controller what kind of sensor has been installed on that terminal.
3. Press the  **Station Settings** button.  counter-clockwise to quickly get to the

Sensor Setup Menu.



4. Use the arrow keys to navigate to **Input**.  to select the desired input terminal.
5. Use the arrow keys to navigate to **Typ**.  to select the correct sensor type.

Pressure Sensor Configuration



Min: Minimum pressure permitted for operation.

Max: Maximum pressure permitted for operation.

Unit: Select English or Metric for display of pressure in pounds per square inch (psi) or bar.

Alarm: Select either a high limit alarm (Hi) or a low limit alarm (Lo). In the **Set:** field, it is possible to turn the Hi or Lo alarm On or Off.

QTime: Qualification time. How long does the alarm condition (max pressure exceeded, for example) have to stay in that condition for the alarm to be triggered.

RTime: Reset time. Clears the alarm automatically if alarm condition no longer exists for that period of time.

Act: If an alarm is triggered, this is the Action that the controller will take. Possible choices are:

- **None.** The alarm will only alert the operator.

- **Start Station.** Starts a specified station.
- **Cancel Station.** Cancels a specified station.
- **Cancel All.** Cancels all irrigation activity.
- **Rain Hold.** Places a rain hold on the controller for a specified number of days.

PType: The type of pressure sensor installed, typically defined by the maximum pressure of the sensor. Check your sensor's documentation for the correct number (typically 200 psi).

Temperature Sensor Configuration

```
Input : 7   Typ:TEMP
Min   : 001 C
Max   : 040 C
Unit  : Metric (C)
Alarm : Hi  Set: On
QTime : 010m
RTime : 015m
Act   : Rain Hold
Hold  : Today
```

Min: Minimum temperature permitted for operation.

Max: Maximum temperature permitted for operation.

Unit: Select either English or Metric for display of temperature readings in either Fahrenheit or Celcius.

Alarm: Select either a high limit alarm (Hi) or a low limit alarm (Lo). In the **Set:** field, it is possible to turn the Hi or Lo alarm On of Off.

QTime: Qualification time. How long does the alarm condition (max temperature exceeded, for example) have to stay in that condition for the alarm to be triggered.

RTime: Reset time. Clears the alarm automatically if alarm condition no longer exists for that period of time.

Act: If an alarm is triggered, this is the Action that the controller will take. Possible choices are:

- **None.** The alarm will only alert the operator.
- **Start Station.** Starts a specified station.
- **Cancel Station.** Cancels a specified station.
- **Cancel All.** Cancels all irrigation activity.
- **Rain Hold.** Places a rain hold on the controller for a specified number of days.

Flow Sensor Configuration

```
Input : 2   Typ:FLOW
I_WTW : 06:00pm
O_WTW : 02:00am
I_Min  : 00020 gpm
I_Max  : 00200 gpm
O_Max  : 00010 gpm
Unit   : English(gpm)
Alarm  : Hi  Set: On
QTime  : 001m
RTime  : 002m
Act    : Cancel All
Make   : Custom
Kval   : 0000.000
Off_s  : 00.000
```

I_WTW: In Water Time Window. Set a time when watering can begin.

O_WTW: Out Water Time Window. Set a time when irrigation is no longer permitted.

I_Min: For standalone. Minimum flow rate allowed at the beginning of the water window.

I_Max: Paired with I_Min. Maximum flow rate allowed during the water window.

O_Max: Maximum flow rate allowed outside of water window. One might typically set this value rather low to help detect valve or sprinkler leaks.

Unit: Select either English or Metric for display of flow rates in either gallons per minute (gpm) or liters per minute (lpm).

Alarm: Select either a high limit alarm (Hi) or a low limit alarm (Lo). In the **Set:** field, it is possible to turn the Hi or Lo alarm On of Off.

QTime: Qualification time. How long does the alarm condition (high flow limit exceeded, for example) have to stay in that condition for the alarm to be triggered.

RTime: Reset time. Clears the alarm automatically if alarm condition no longer exists for that period of time.

Act: If an alarm is triggered, this is the Action that the controller will take. Possible choices are:

- **None.** The alarm will only alert the operator.
- **Start Station.** Starts a specified station.
- **Cancel Station.** Cancels a specified station.
- **Cancel All.** Cancels all irrigation activity.
- **Rain Hold.** Places a rain hold on the controller for a specified number of days.

Make: Select the manufacturer of the flow sensor. Choices are Data Industrial, Bermad, or Custom.

Kval: Review your flow sensor's documentation for its

correct K Value.

Off_s: Review your flow sensor's documentation for its correct Offset value.

PPG (if Bermad selected): Pulse per gallon based on flow meter wiring. See your Bermad flow meter documentation for proper setting.

Rain Bucket Configuration

```
Input : 3   Typ:RAIN
Tip   : 0.01 in
Max   : 01.00 in
Unit  : English (in)
Alarm : On
R_win : 24hr
Act   : Rain Hold
Hold  : 02days
Count : 4
Hr: 02 H_Cnt:00001
```

Tip: The amount of water per tip. The typical rain bucket might have a tip point of 0.01". Check your rain bucket's documentation for correct tip point.

Max: This is the limit at which the alarm will trip. If the Tip unit is 0.01 inch, and the Max limit is 1 inch, it would take 100 tips (within the R_win window) to trigger the alarm.

Unit: Select either English or Metric for display of rain bucket data in either inches or millimeters.

Alarm: On or Off. Turn on the alarm

R_win: Set the period of time (as a moving window) that the controller will calculate rain bucket tips towards reaching the max limit.

Act: If an alarm is triggered, this is the Action that the controller will take. Possible choices are:

- **None.** The alarm will only alert the operator.
- **Start Station.** Starts a specified station.
- **Cancel Station.** Cancels a specified station.
- **Cancel All.** Cancels all irrigation activity.
- **Rain Hold.** Places a rain hold on the controller for a specified number of days.

Count: The number of times the rain bucket has filled and "tipped", independent of Alarm status and R_Win setting.

Hr: Possible to go back in hour increments to review the number of tips during that hour from the current time.

H_Cnt: The number of tips in that hour.

Total: The number of times the rain bucket has filled and "tipped" in the rain window (R_win above) only when the alarm is set to On.

Status Sensor Configuration

```
Input : 4   Typ:STAT
Sw    : Norm Close
Alarm : On
QTime : 10s
RTime : 01m
Act   : Cancel All
```

Sw: Normally Closed or Normally Open.

Select the correct setting for your sensor.

Alarm: Turn the alarm On or Off for the sensor.

QTime: Qualification time. How long does the alarm condition (normally closed becoming open, for example) have to stay in that condition for the alarm to be triggered.

RTime: Reset time. Clears the alarm automatically if alarm condition no longer exists for that period of time.

Act: If an alarm is triggered, this is the Action that the controller will take. Possible choices are:

- **None.** The alarm will only alert the operator.
- **Start Station.** Starts a specified station.
- **Cancel Station.** Cancels a specified station.
- **Cancel All.** Cancels all irrigation activity.
- **Rain Hold.** Places a rain hold on the controller for a specified number of days.

Reviewing Sensor Data

After installing and configuring sensors, it is possible to review sensor data as it is transmitted to the controller.

1. Press the  **Diagnostic** button.
2. Turn the Command dial  to **Sensor Monitor**.

```
Menu: Sensor Monitor
▶Sensor Board Slot 8
P1: 150.7 R2: 00.12
S3: Open F4: 33.10
R5: 00.14 I6: NONE
T7: 73 PW: +12V
```

In the Sensor Monitor screen above:

- **P1:** a pressure sensor is installed on input 1
- **R2:** a rain bucket is installed on input 2
- **S3:** a status sensor is installed on input 3
- **F4:** a flow sensor is installed on input 4
- **R5:** a rain bucket is installed on input 5
- **I6:** input 6 does not have a sensor attached
- **T7:** input 7 has a temperature sensor attached

Units explained:

To see what units the numbers are in, press the down arrow to get to the last line. The units of the numbers will switch between an explanation of the metric and English designations.

Designation	Unit
P	psi
p	kPa
F	gpm
f	lpm
R	inches
r	mm
T	Fahrenheit
t	Celcius

Clearing Alarms

The Home screen will display any current alarms with the board and the terminal called out.

```
Mon 04/17/17 02:33pm
Sat# 001-001 Sec. 10
!ALARM! BRD 8 Sen 1
Day Change: 12:00am
Lynx Smart Satellite
```

1. Press the  **Diagnostic** button.
2.  to **Sensor Monitor**.
3. Use the arrow keys to navigate to the desired input so that it is highlighted.
4. Simply turn the Control Dial to clear the alarm.

Reset Sensor Settings

If it becomes necessary to reset all sensor settings:

1. Press the  **Satellite Settings** button.
2. Down arrow to **Reset SIB's**.
3.  to change to **Yes All**.

```
Hold Rain : None
Reset Prg's: No
Reset Sta's: No
Reset Unit : No
▶Reset SIB's: No
Enabl Sta's: No
```

4. There is a confirmation screen. Press the **Stop** button to cancel the reset.

Firmware Version

A handful of satellites will need a firmware update to take advantage of the Lynx Smart Satellite Sensor Kit.

To check your satellite's firmware:

1. Press the  **Diagnostic** button.
2. Turn the Command dial  to **Revision**.
3. Check Revision number. If firmware revision is less than 2.0, see your Toro distributor for a firmware update.

Sensor Configuration - Lynx



Sensor configuration can either be done at the satellite in Local Mode or at a Central computer running Lynx. If communication is established between a satellite and a Lynx system, the Lynx system *will overwrite all locally defined sensor configuration information*. Meaning, if operating a Lynx system, the sensors must be configured with Lynx.

Configuring Sensors

It is possible to add and configure sensors from the Central computer running Lynx.

All sensors must be physically wired to the satellite controller and communication between the Central and satellite already established.

Lynx can detect if a pressure and/or temperature sensor is attached to the board. However, the sensor must still be configured.

Procedure

1. Click the **New Board** button.
2. Under the Satellite column, you will see a satellite selection of “Unassigned”. We have to assign the Sensor Input Board (the new board from step 1) to the correct satellite. Click the “Unassigned” word and select the correct satellite from the dropdown menu.
3. Now we need to specify which sensors are installed in which inputs. Click **Sensor Configuration**.
4. Simply click on a field to change the value. In **Figure 1**, we have one of each type of sensor installed with minimum and maximum values set
5. Remember, a sensor input board takes up 8 stations and includes 8 stations. We have to tell Lynx that the correct satellite from step 2 now has 8 fewer or 8 additional stations depending on the installation details. Click on **Control System**, find the desired satellite, and enter the correct number of stations (see **Figure 2**: a 64 station satellite has been changed to 56 stations by removing a 16 station output module and replacing it with a sensor kit module.).
6. Click **Alarm-Response** to set up alarm conditions for the various sensors.

Figure 1

Satellite		1-1*				
Number	Name	Type	Minimum	Maximum	Configure	
1	Pressure[1]	Pressure	0	500		
2	Status[2]	Status	0	1	Open/Closed	
3	Rain[3]	Rain	0	40		
4		Available	0	0		
5		Available	0	0		
6	Flow[6]	Flow	0	100	0x+0 [xUnassigned]	
7	Temperature[7]	Temperature	-40	199		

Figure 2

Group	Name	Link
1	1	Wire Link 1 (COM1)

Satellite	Name	Number of Stations	Simultaneous Stations	Maximum Stations	Amps
1 *		56	6	64	3.20
2 *		56	6	64	3.20
3 *		56	6	64	3.20
4 *		56	6	64	3.20

Figure 3

Alarm-Response

Name: New Sensor Board: Flow High
Description: Enter a description for this configured Alarm-Response

Alarm Configuration

Select sensor: Sensor: S1 - 1-1 : Flow[6]

Limit: Out of Window: 500 gpm, Inside Window: 500 gpm

Qual. Times: Set: 1 min., Reset: 1 min.

Response Configuration

Selected Responses: Download Satellite

Active Response Editor: Download the triggering Satellite.

Note: This Response should only be associated with the following Alarms:

- Select the desired sensor from the dropdown list. Enter the various limits and Qualification times (**Figure 3**). For an explanation of these terms, please see the **Sensor Configuration** section above.

 Checking the **Use Local Response** checkbox turns on a switch in the satellite containing the sensor board for a timed duration.

Reviewing Sensor Data

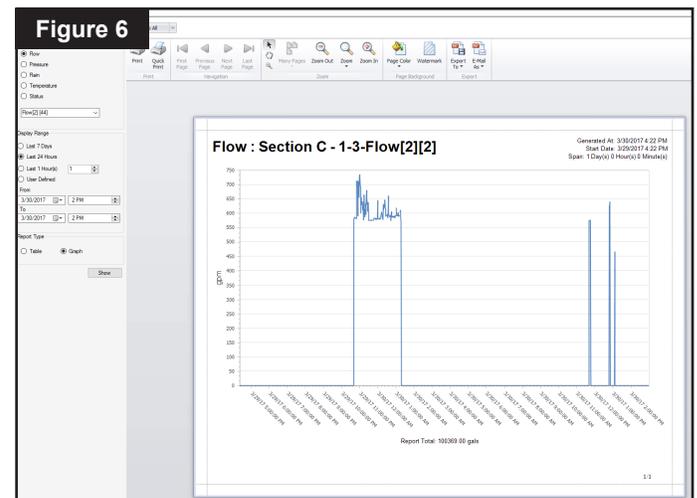
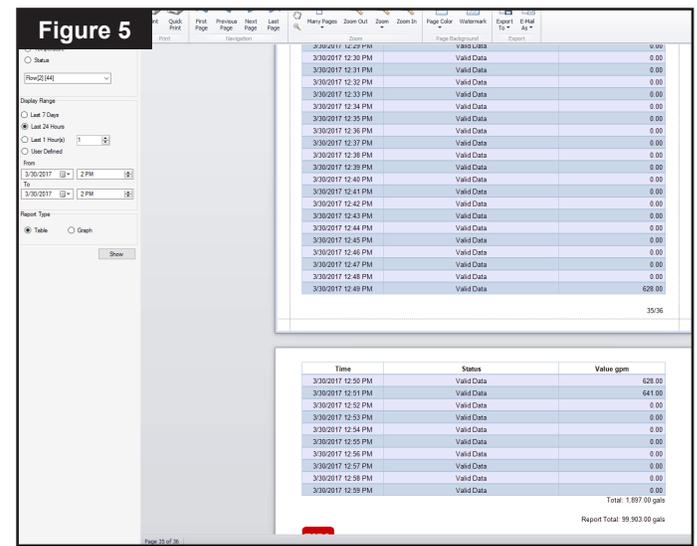
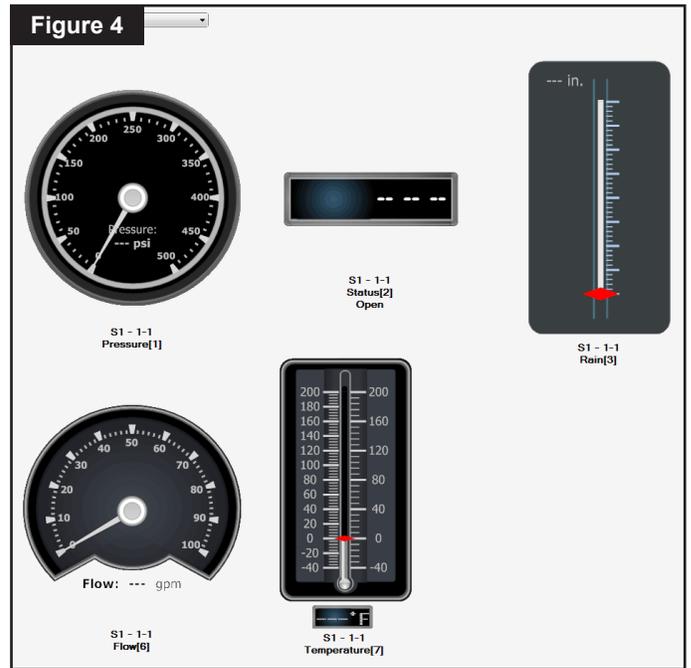
It is possible to review sensor information in realtime or historically.

Realtime:

Click **Utilities** then **Sensor Dashboard**. Select the Sensor Input Board to monitor. You will see a screen similar to **Figure 4**, though the number and type of sensors might be different, as well as the ranges for the sensors.

Historic:

Click **Report Generator** then **Sensors**. Select the desired sensor, the date range, and whether to view the sensor data as a table (**Figure 5**) or graph (**Figure 6**).



The Toro Promise - Limited One-Year Warranty

The sensor input board is covered by this warranty for a period of one year from the date of installation.

Neither Toro nor Toro Warranty Company is liable for indirect, incidental or consequential damages in connection with the use of equipment, including but not limited to: vegetation loss, the cost of substitute equipment or services required during periods of malfunction or resulting non-use, property damage or personal injury resulting from installer's actions, whether negligent or otherwise. Some states do not allow the exclusion

of incidental or consequential damages, so the above exclusion may not apply to you.

All implied warranties, including those of merchantability and fitness for use, are limited to the duration of this express warranty. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. This warranty gives you specific legal rights and you may have other rights which vary from state to state.

Electromagnetic Compatibility

This device complies with FCC rules Part 15. Operation is subject to the following two conditions: (1) This device may not cause harmful interference and (2) this device must accept any interference that may be received, including interference that may cause undesirable operation. This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instruction, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a FCC Class B computing device in accordance with the specification in subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that the interference will not occur in a particular installation.

If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- (1) Reorient or relocate the receiving antenna.
- (2) Increase the separation between the equipment and receiver.
- (3) Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- (4) Consult the dealer or an experienced radio or television technician for assistance. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to identify and Resolve Radio-TV Interference Problems". This booklet is available from the U.S. Government Printing Office, Washington, DC 20402. Stock No. 004-00345-4m.

