396-4035Y1

SureFire Ag Systems

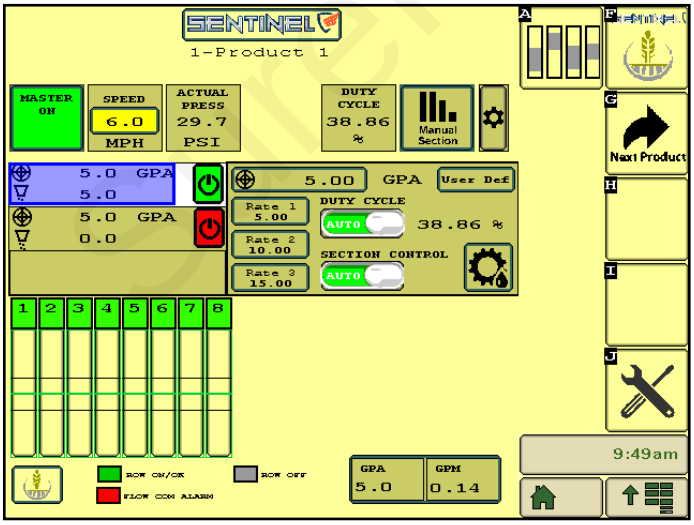
SENTINEL

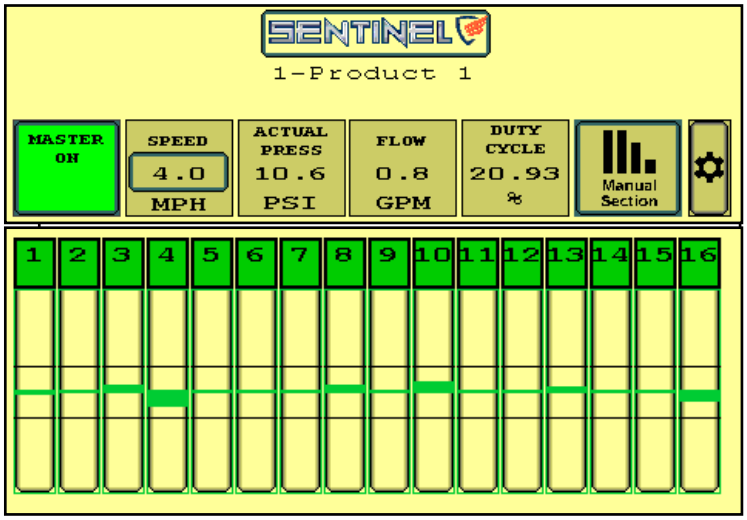
LIQUID ROW MONITOR and RATE CONTROL

Sentinel Liquid Row-Flow Monitor
Sentinel Rate Control

for ISOBUS

Installation and Setup





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Safety

TAKE NOTE! THIS SAFETY ALERT SYMBOL FOUND THROUGHOUT THIS MANUAL IS USED TO CALL YOUR ATTENTION TO INSTRUCTIONS INVOLVING YOUR PERSONAL SAFETY AND THE SAFETY OF OTHERS. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN INJURY OR DEATH.

THIS SYMBOL MEANS ATTENTION!

BECOME ALERT!

YOUR SAFETY IS INVOLVED!

Note the use of the signal words DANGER, WARNING and CAUTION with the safety messages. The appropriate signal word for each has been selected using the following guidelines:

DANGER: Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations typically for machine components which, for functional purposes, cannot be guarded.

WARNING: Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.

CAUTION: Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTICE is used to address safety practices not related to personal safety.

DANGER

Hydraulic Fluid and Equipment Safety

This system uses hydraulic equipment with hydraulic fluid under extremely high pressure.

Hydraulic fluid escaping under pressure can have sufficient force to penetrate the skin causing serious injury. Keep all hoses and connections in good serviceable condition. Failure to heed may result in serious personal injury or death. Avoid the hazard by relieving the pressure before disconnecting lines or performing work on the system.

Make sure hydraulic fluid connections are tight and all hydraulic hoses and lines are in good condition before applying pressure to the system. Use a piece of paper or cardboard, NOT BODY PARTS, to check for suspected leaks. Wear protective gloves and safety glasses or goggles when working with hydraulic systems. DO NOT DELAY!

Check hydraulic hoses and fittings frequently. Loose, broken, and missing hardware can cause equipment to not perform properly and can result in serious injury or death.
Hydraulic systems can be hot and cause burns. Before working on any system, wait until the fluid has cooled.

If an accident occurs, see a doctor familiar with this type of injury immediately. Any fluid injected into the skin or eyes must be treated within a few hours or gangrene may result.

A Word to the Operator

It is YOUR responsibility to read and understand the safety messages in this manual. YOU are the key to safety.

SAFETY IS YOUR RESPONSIBILITY.

General Description

A
Introduction

You have purchased a SureFire Sentinel system for your equipment. This system will be controlled by the Sentinel ECU through your in-cab ISO display. If you are using the Sentinel for row monitoring, your liquid system will continue to function as usual with application rates being regulated by your existing rate control. The Sentinel works independently, monitoring the row-to-row accuracy of your system and alerting the operator of over-applying, restricted or blocked rows.

If you are using Sentinel for Rate Control, the Sentinel ECU will be the rate controller for your system.

SureFire currently supports Sentinel operating on the following displays: **John Deere** 2630 & 4640, **Ag Leader** InCommand 800 and 1200, **Case IH** Pro 700 and Pro 1200, and **Trimble** TMX-2050. The use of Sentinel on any other display may result in diminished functionality.

A 2-pin Molex power and 12-pin Ampseal Power/CAN connector are required on your implement to connect the Sentinel ECU to the implement bus. While some equipment manufacturers already provide this connection, SureFire offers harnessing to provide this connection on any implement. Ask your SureFire representative what accommodations may be needed for your specific equipment.

Basic Installation Steps for Row Monitoring

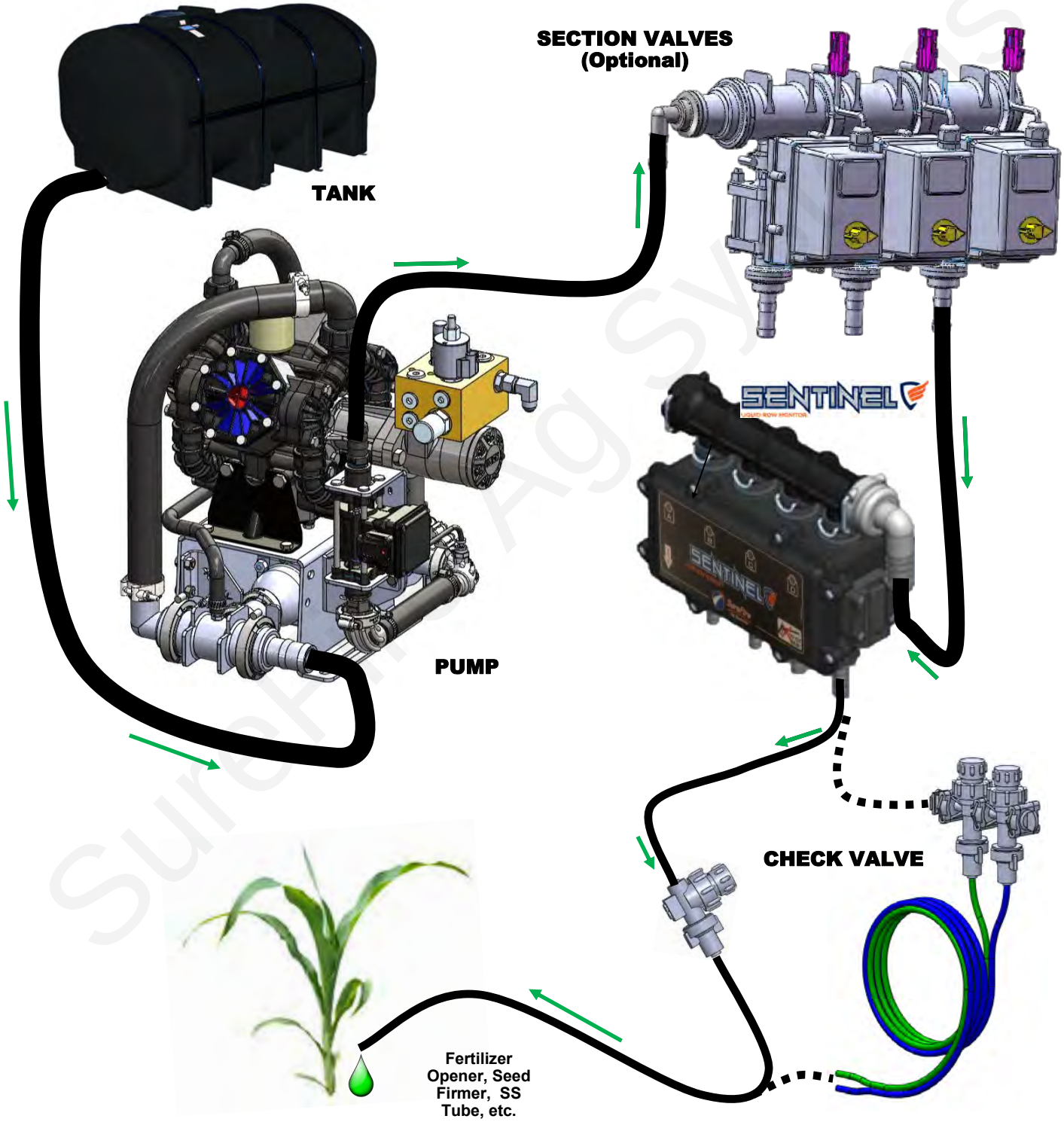
1. Manifold together the Sentinel flow modules as necessary to obtain the correct section-control configuration.
2. Mount the Sentinel flow modules as necessary using existing or provided brackets and hardware.
3. If necessary, route the provided ISO extension cable from the implement hitch to the desired Sentinel ECU mounting location.
4. Locate the 2-pin Molex power and 12-pin Ampseal POWER/CAN connectors that the Sentinel ECU will be connected to and remove the terminator.
5. Mount the Sentinel ECU using the provided bracket in a location within 4 feet of the above connection.
6. Attach the ECU harness (208-06-3536Y2) to the Sentinel ECU and plug the other end of the harness into the above Molex/Ampseal POWER/CAN connection.
7. Use the previously removed terminator to terminate the POWER/CAN connection found on the ECU harness.
8. Locate the CAN Trunkline harness (208-06-29XX) and plug the 4-pin Amp Superseal connectors into the open connection on Flow module(s) as shown on page 7.
9. Route this harness to the ECU harness, using 4-pin Deutsch extensions when needed.
10. Locate the “Flowmeter Bus” connector on the ECU harness. Remove the terminator (208-06-2912Y1) and plug the 4-pin Deutsch from the flow modules into this connection.
11. Move the terminator to the open 4-pin connector on the end of the CAN Trunkline harness.
12. From the in-cab display, address the flow modules and configure the implement as outlined in the setup instructions in this manual beginning on page 14.

System Overview Example 1

B
Components
Liquid

The following gives an example of a complete SureFire Fertilizer system with these components:

- Tank
- Pump
- Section Valves
- Sentinel Flow Monitor
- Check Valve
- Optional: Dual metering tube plumbing

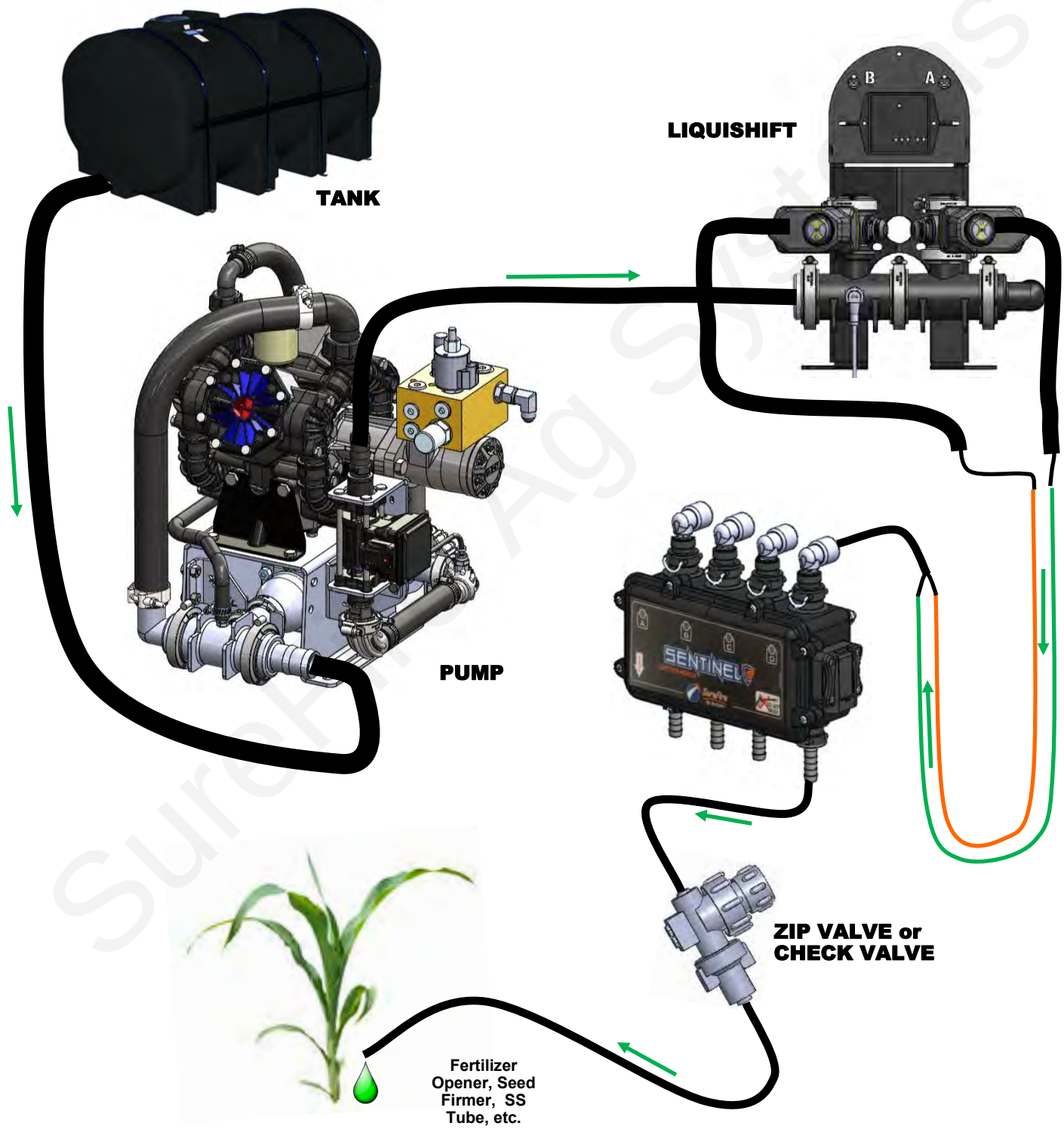


System Overview Example 2

B
Components
Liquid

The following gives an example of a complete SureFire Fertilizer system with LiquiShift and these components:

- Tank
- Pump
- LiquiShift Valve Stack
- Sentinel Flow Monitor
- Zip Valves or Check Valves



Parts and Fittings

Manifold Feed

ITEM NO.	PART NUMBER	DESCRIPTION
1	204-01-4625AAGB1B1	Sentinel™ Flowmeter Module
2	120-T3MT3F-4XT1M	T3 Male/Female Manifold w/ (4)T1 Male Outlets
3	124-02-010003	T3 Fork
4	120-T3FTEE	T3 Tee
5	120-T3MPLUG	T3 Male FC Plug
6	124-02-010004	T4 Fork
7	120-T4FT3FRC	T4 Female x T3 Female FC Reducer Coupling
8	120-T4MT3MRN	T4 Male x T3 Male FC Reducer Nipple
9	121-T3M075-90	T3 Male FC x 3/4" HB - 90 degree
10	121-T3F075	T3 Female x 3/4” HB
11	124-01-G11056-V	Viton O-Ring for T1 fittings
12	124-01-G11058-V	Viton O-Ring for T3 fittings
13	124-01-G11054-V	Viton O-Ring for T4 fittings

See next page for a list of T1 fittings

Parts and Fittings
for
Isolated Rows

Commonly used Quick-Connect (QC) Fittings

Part Number	Description
113-12-038038	Stem Elbow—3/8” Stem x 3/8” QC
113-05-025	Plug - 1/4” QC
13-05-038	Plug - 3/8” QC

T1 Fittings

Part Number	Description
120-T1M038QC	T1 Male x 3/8” QC
120-T1M025QC	T1 Male x 1/4” QC
121-T1M038	T1 Male x 3/8” HB
121-T1M050	T1 Male x 1/2” HB
124-01-G11056-V	Viton O-ring for T1 Fittings

Sentinel Flow Meter

Part Number	Description
204-01-4625AAGB1B1	4-Row Sentinel flow meter
124-02-010001	T1 Fork
374-4024Y1	4-Pin Amp Superseal dust plug
384-1105	Hardware Kit - mounting bolts

SureFire Harness Layout for ISO Sentinel

The SureFire Sentinel module communicates with the Sentinel ECU through a proprietary communication network (CAN). The Sentinel ECU then, using the ISOBUS communication protocol, relays the flow information through the tractor ISOBUS and generates the user interface on the in-cab display. A series of connections are required to form this communication network.

Tractor Connection

Designed to integrate with any implement, in some cases, connecting the Sentinel starts at the tractor's ISOBUS connection. Power and information is relayed to the Sentinel ECU using a SureFire Front ISO Extension which includes power and CAN bus connections. Already using the tractor ISOBUS? No Problem. SureFire carries ISOBUS-Y harnesses to split the ISO connection at the tractor.

Implement Height and Speed Input

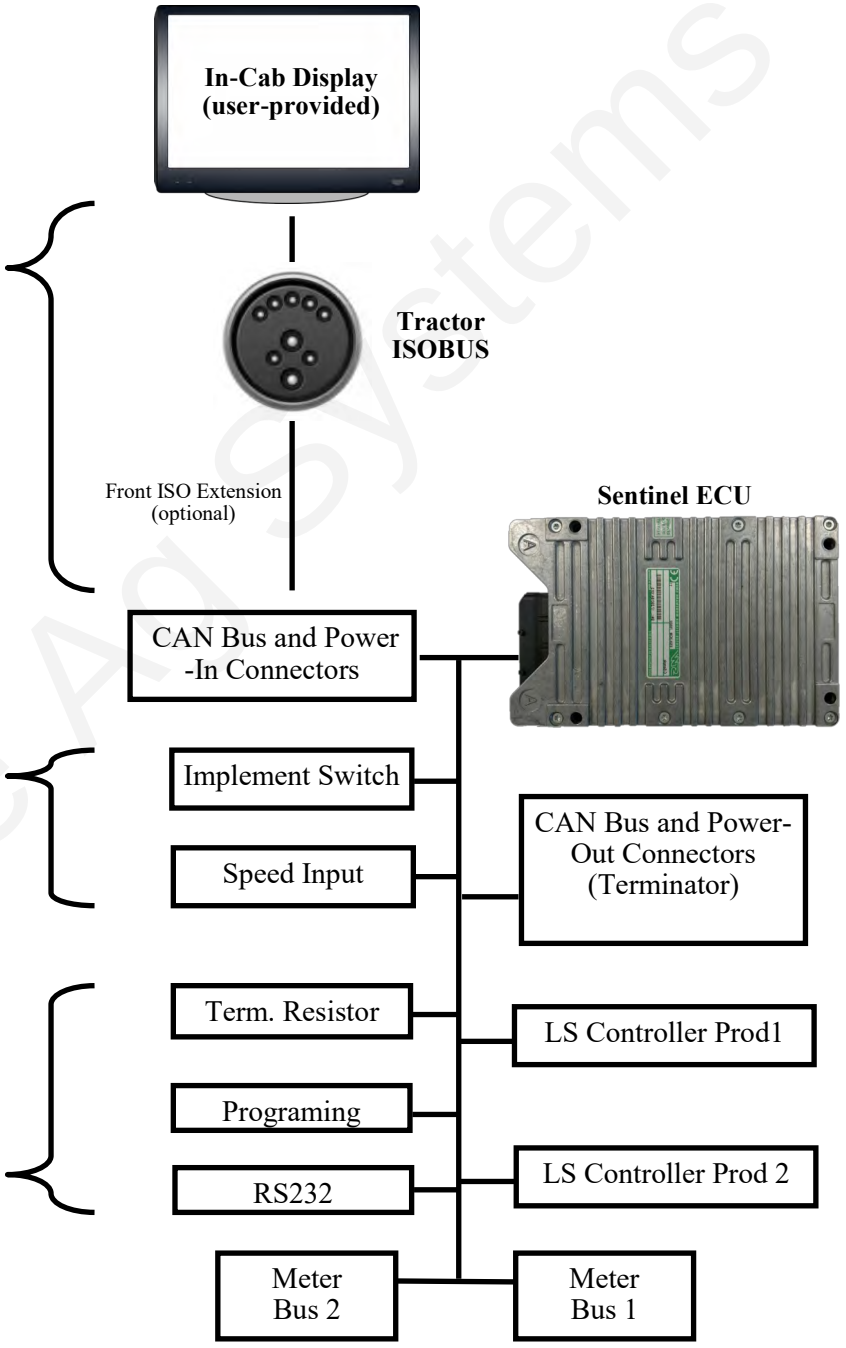
Not used in all configurations, the implement height and speed input connections provide additional input options in situations that require advanced alarm control and an auxiliary speed source. These conditions generally exist only in hybrid systems, utilizing multi-branded components.

Sentinel and LiquiShift

The Sentinel ECU has incorporated software that allows for customized control of up to 2 SureFire LiquiShift systems. When used, the ECU replaces the LiquiShift Controller.

Service Connections

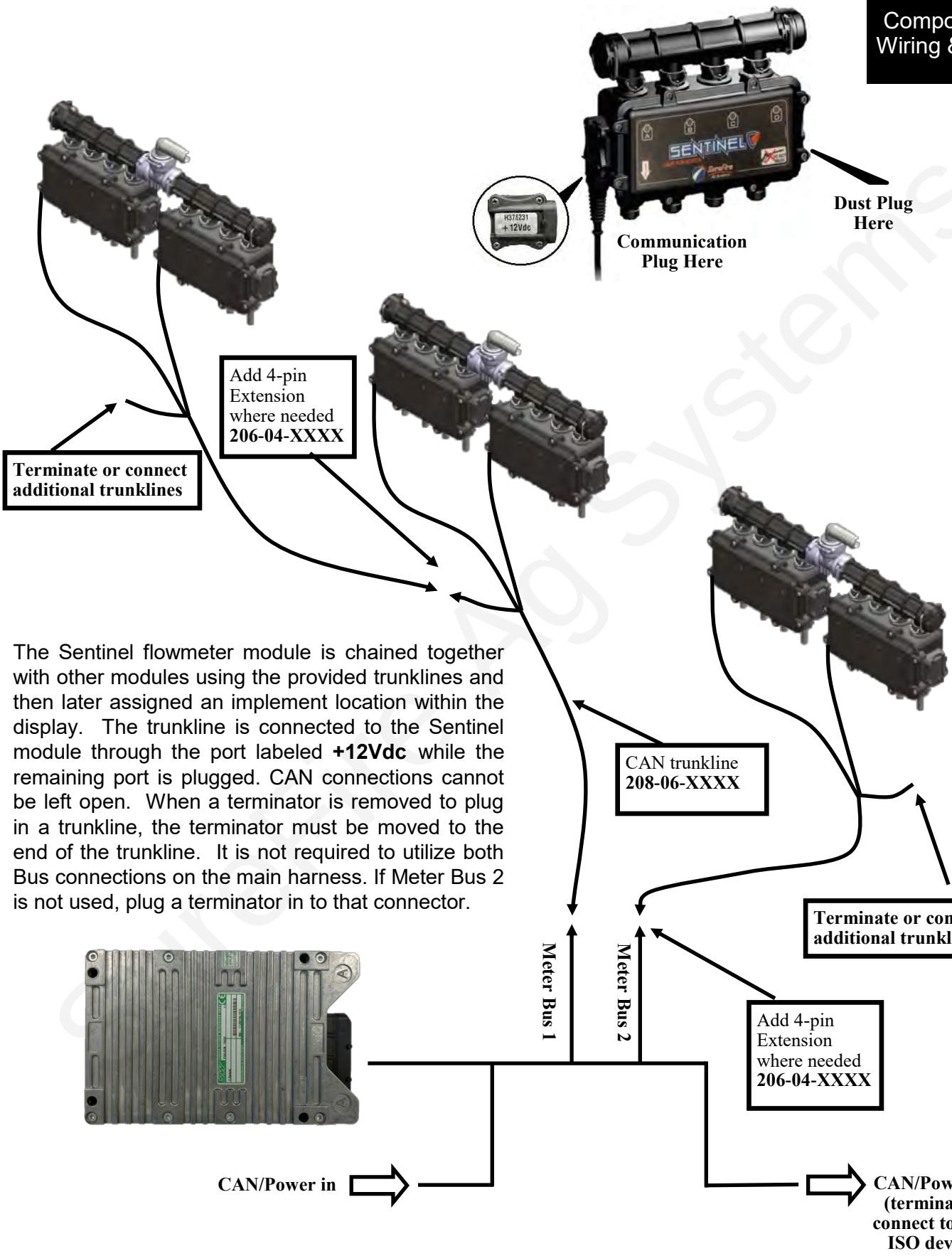
The Terminating Resistor, Programming and RS232 connectors are for service only and should not be used.



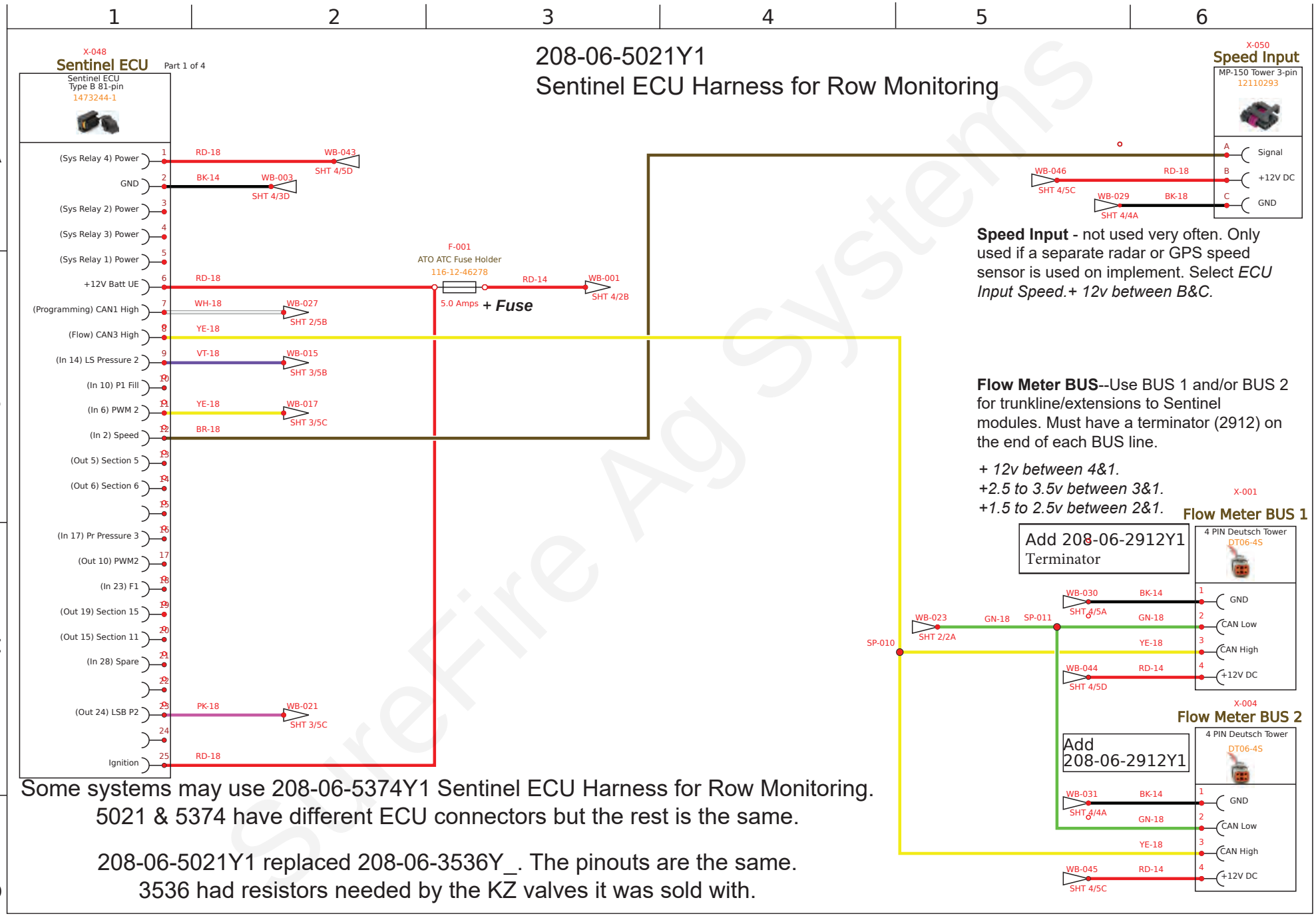
Bus Connections

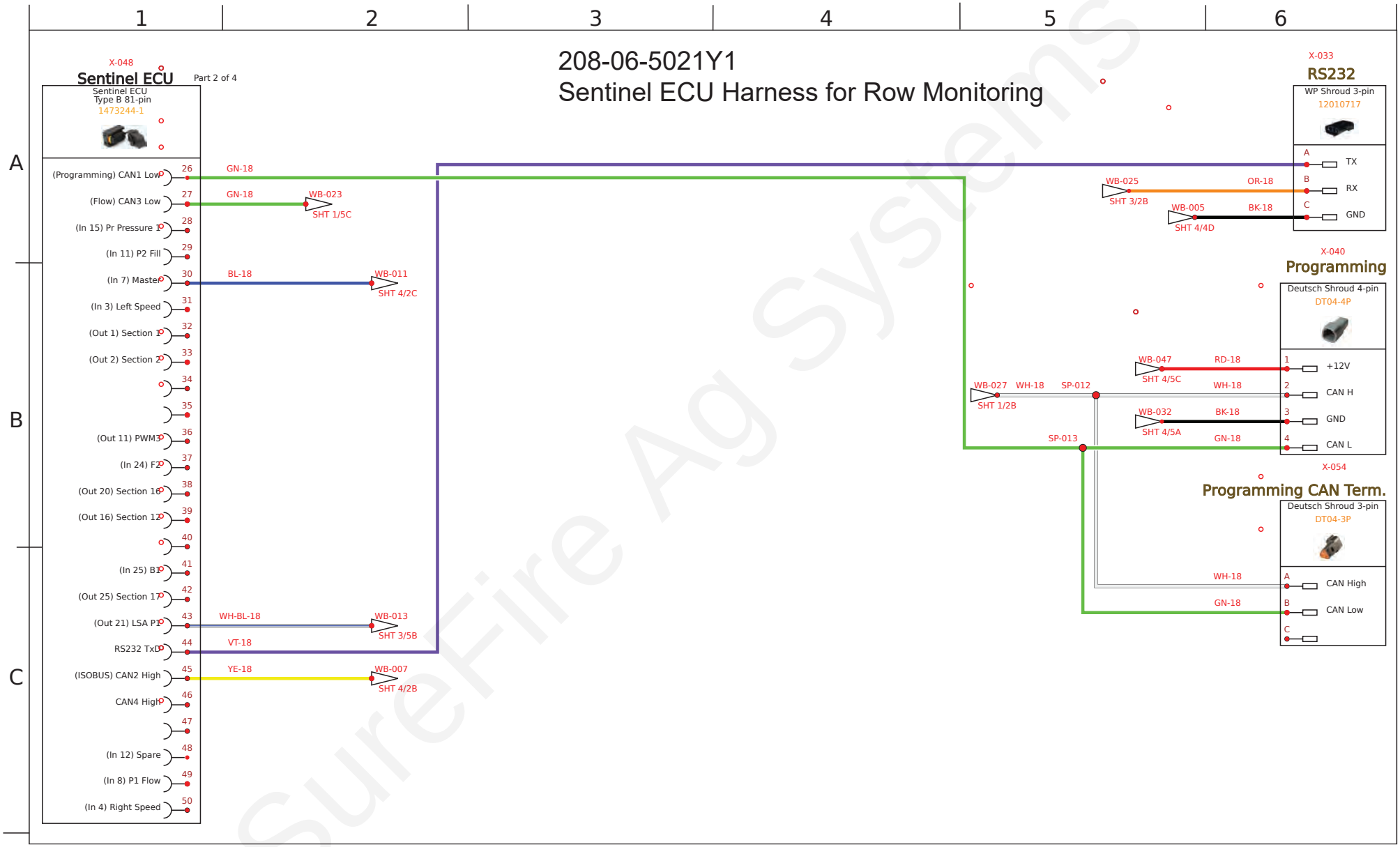
2 Bus connections are provided for convenience so that each side of the implement can plug into the ECU harness without the need for a long, continuous chain of connections.

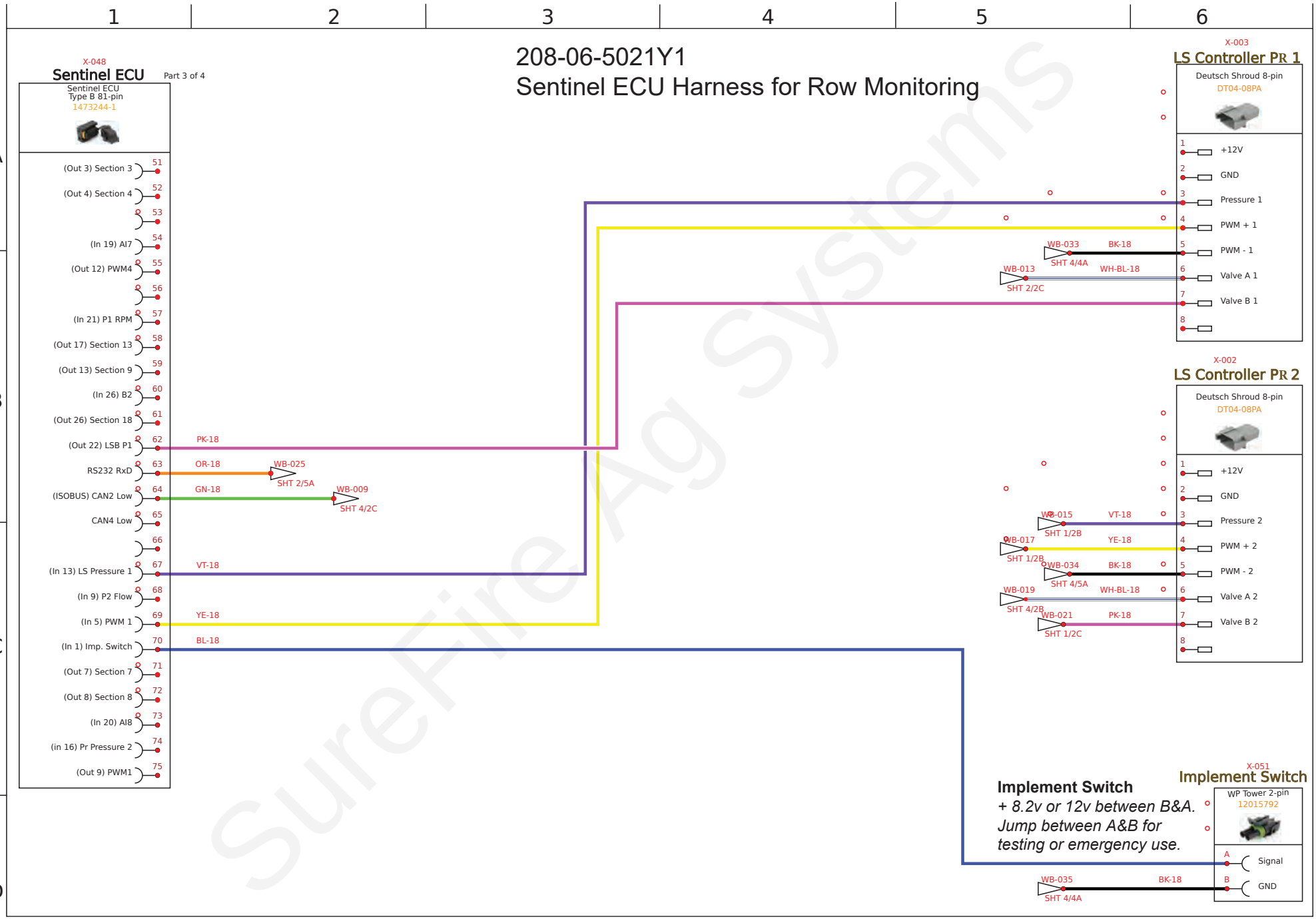
SureFire Harness Layout for ISO Sentinel

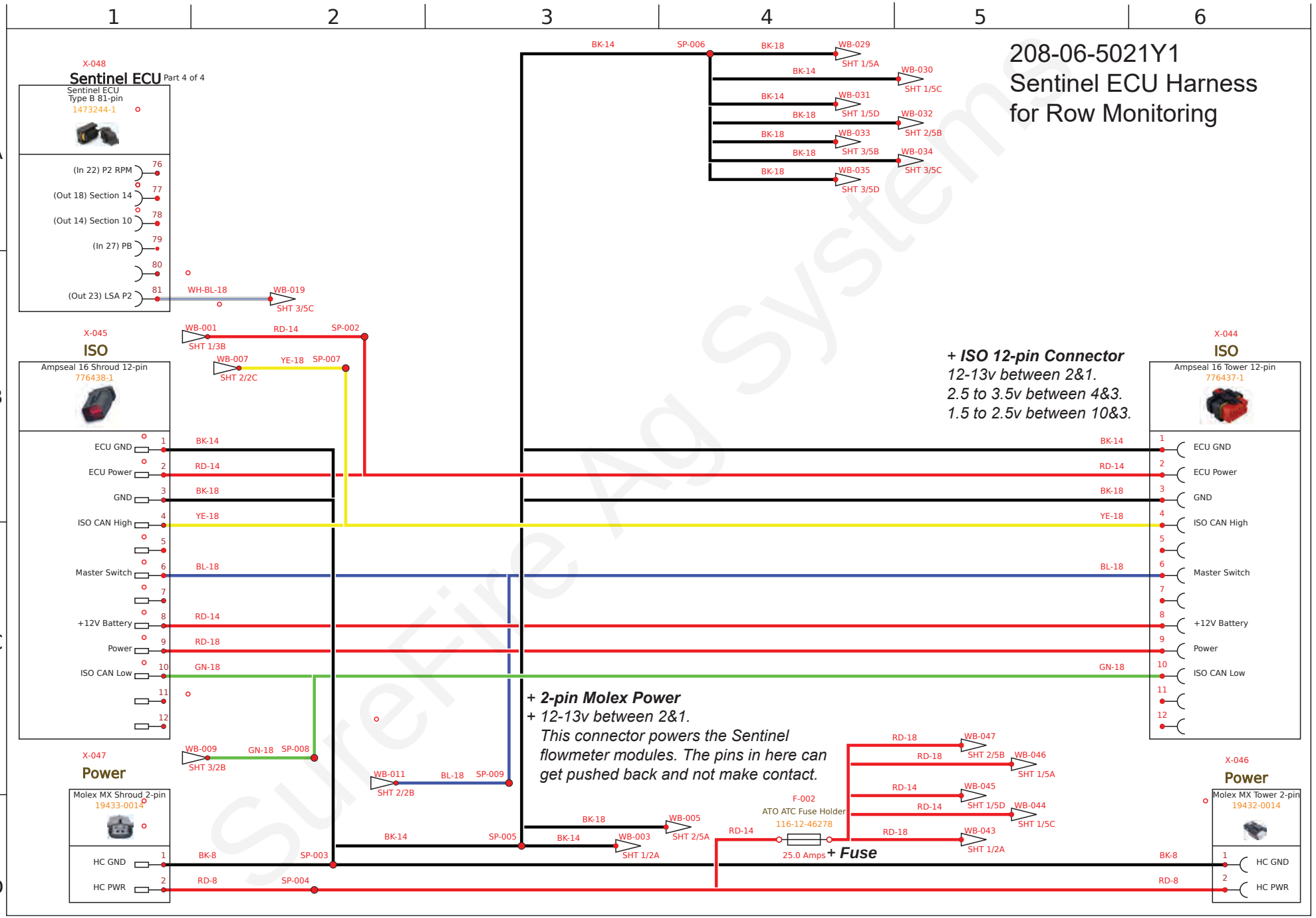


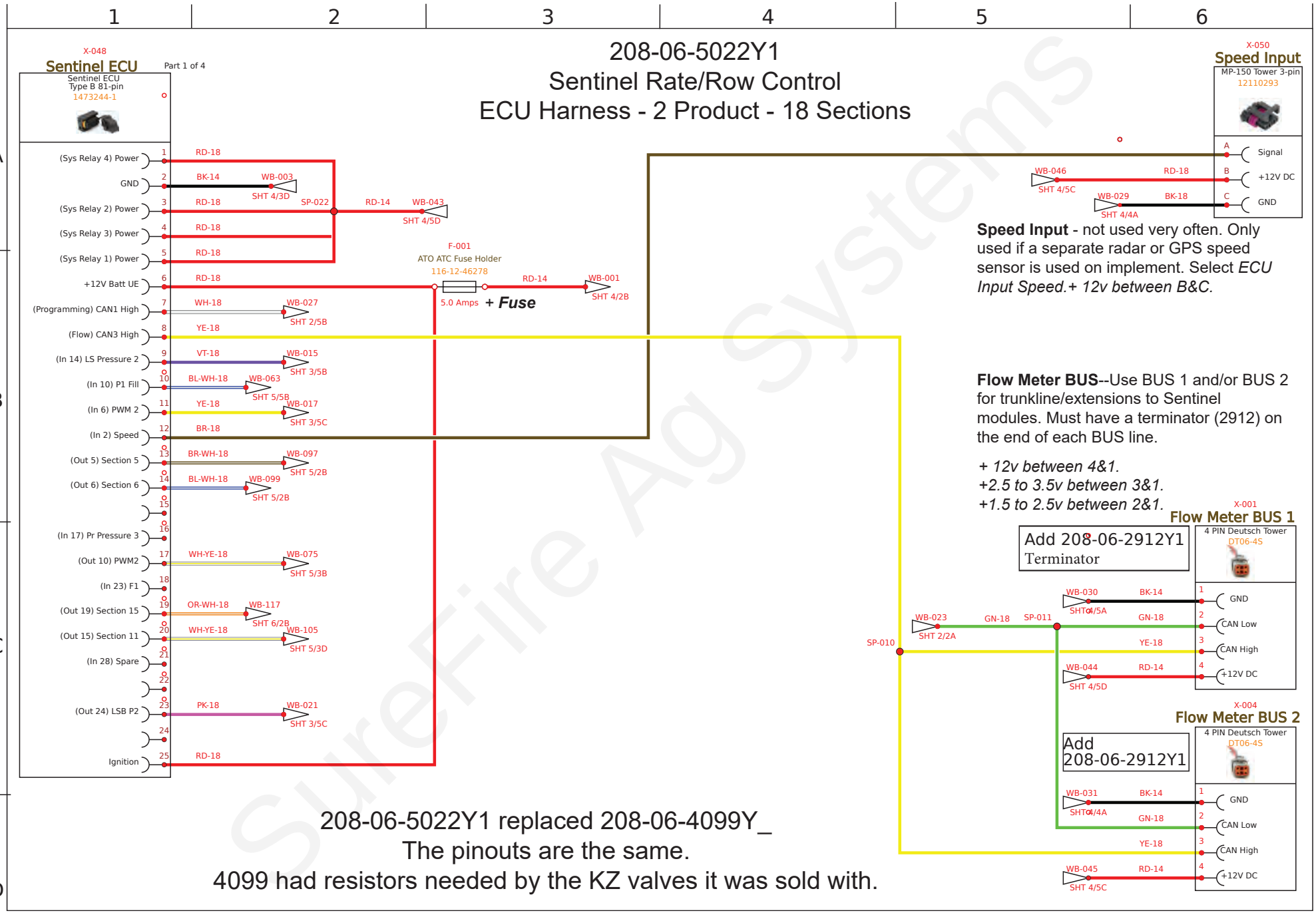
The Sentinel flowmeter module is chained together with other modules using the provided trunklines and then later assigned an implement location within the display. The trunkline is connected to the Sentinel module through the port labeled **+12Vdc** while the remaining port is plugged. CAN connections cannot be left open. When a terminator is removed to plug in a trunkline, the terminator must be moved to the end of the trunkline. It is not required to utilize both Bus connections on the main harness. If Meter Bus 2 is not used, plug a terminator in to that connector.

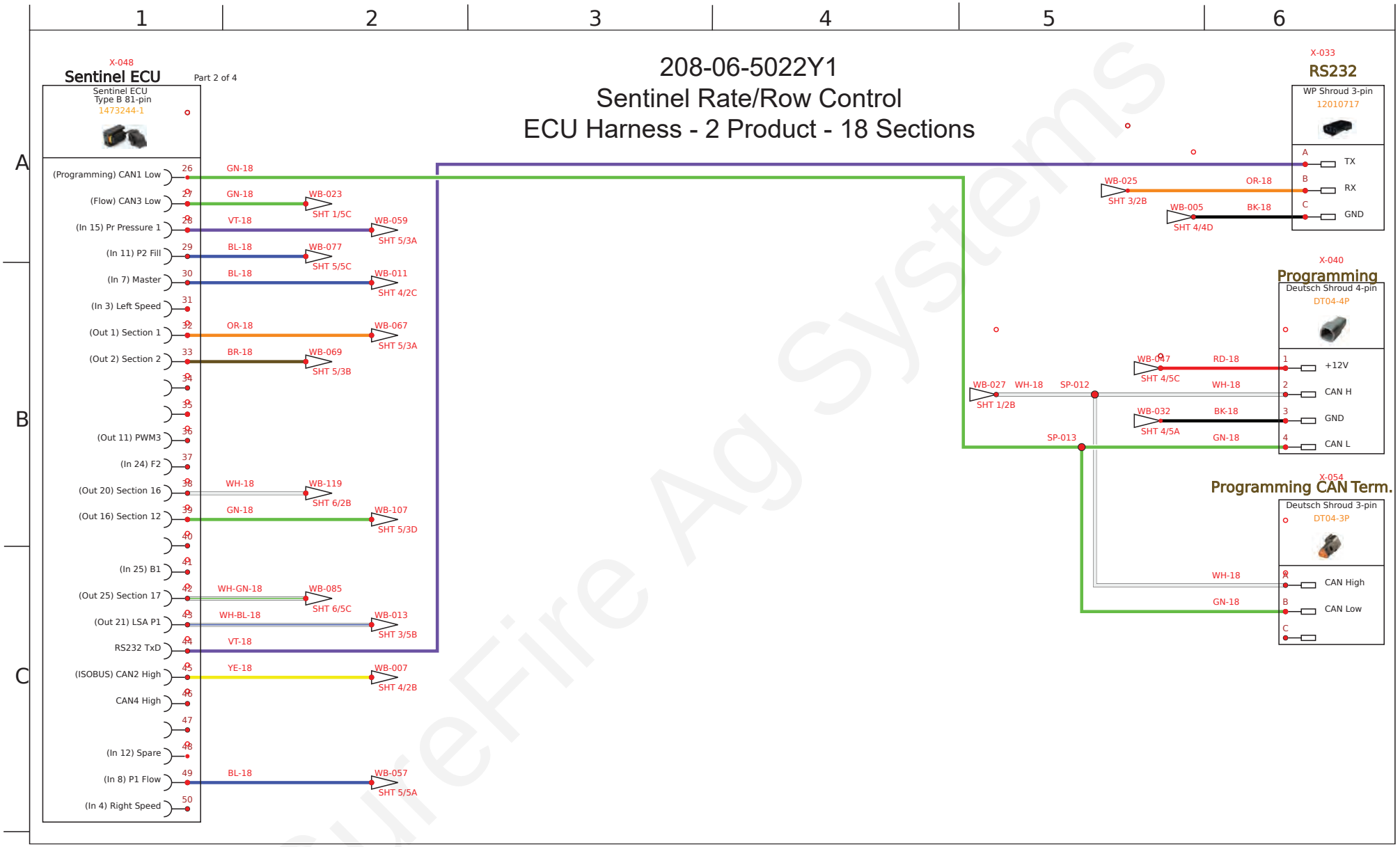

208-06-5021Y1
Sentinel ECU Harness for Row Monitoring
X-048
Sentinel ECU
Part 1 of 4
Sentinel ECU
Type B 81-pin
1473244-1
(Sys Relay 4) Power
GND
(Sys Relay 2) Power
(Sys Relay 3) Power
(Sys Relay 1) Power
+12V Batt UE
(Programming) CAN1 High
(Flow) CAN3 High
(In 14) LS Pressure 2
(In 10) P1 Fill
(In 6) PWM 2
(In 2) Speed
(Out 5) Section 5
(Out 6) Section 6
(In 17) Pr Pressure 3
(Out 10) PWM2
(In 23) F1
(Out 19) Section 15
(Out 15) Section 11
(In 28) Spare
(Out 24) LSB P2
Ignition
RD-18
WB-043
SHT 4/5D
BK-14
WB-003
SHT 4/3D
F-001
ATO ATC Fuse Holder
116-12-46278
5.0 Amps + Fuse
RD-14
WB-001
SHT 4/2B
WH-18
WB-027
SHT 2/5B
YE-18
VT-18
WB-015
SHT 3/5B
YE-18
WB-017
SHT 3/5C
BR-18
PK-18
WB-021
SHT 3/5C
RD-18
X-050
Speed Input
MP-150 Tower 3-pin
12110293
A
Signal
B
+12V DC
C
GND
WB-046
SHT 4/5C
RD-18
WB-029
SHT 4/4A
BK-18
Speed Input - not used very often. Only used if a separate radar or GPS speed sensor is used on implement. Select ECU Input Speed.+ 12v between B&C.
Flow Meter BUS--Use BUS 1 and/or BUS 2 for trunkline/extensions to Sentinel modules. Must have a terminator (2912) on the end of each BUS line.
+ 12v between 4&1.
+2.5 to 3.5v between 3&1.
+1.5 to 2.5v between 2&1.
X-001
Flow Meter BUS 1
4 PIN Deutsch Tower
DT06-4S
Add 208-06-2912Y1
Terminator
WB-030
SHT 4/5A
BK-14
GND
WB-023
SHT 2/2A
GN-18
SP-011
GN-18
CAN Low
SP-010
YE-18
CAN High
WB-044
SHT 4/5D
RD-14
+12V DC
X-004
Flow Meter BUS 2
4 PIN Deutsch Tower
DT06-4S
Add 208-06-2912Y1
WB-031
SHT 4/4A
BK-14
GND
GN-18
CAN Low
YE-18
CAN High
WB-045
SHT 4/5C
RD-14
+12V DC
Some systems may use 208-06-5374Y1 Sentinel ECU Harness for Row Monitoring.
5021 & 5374 have different ECU connectors but the rest is the same.
208-06-5021Y1 replaced 208-06-3536Y_. The pinouts are the same.
3536 had resistors needed by the KZ valves it was sold with.
SureFire Ag Systems

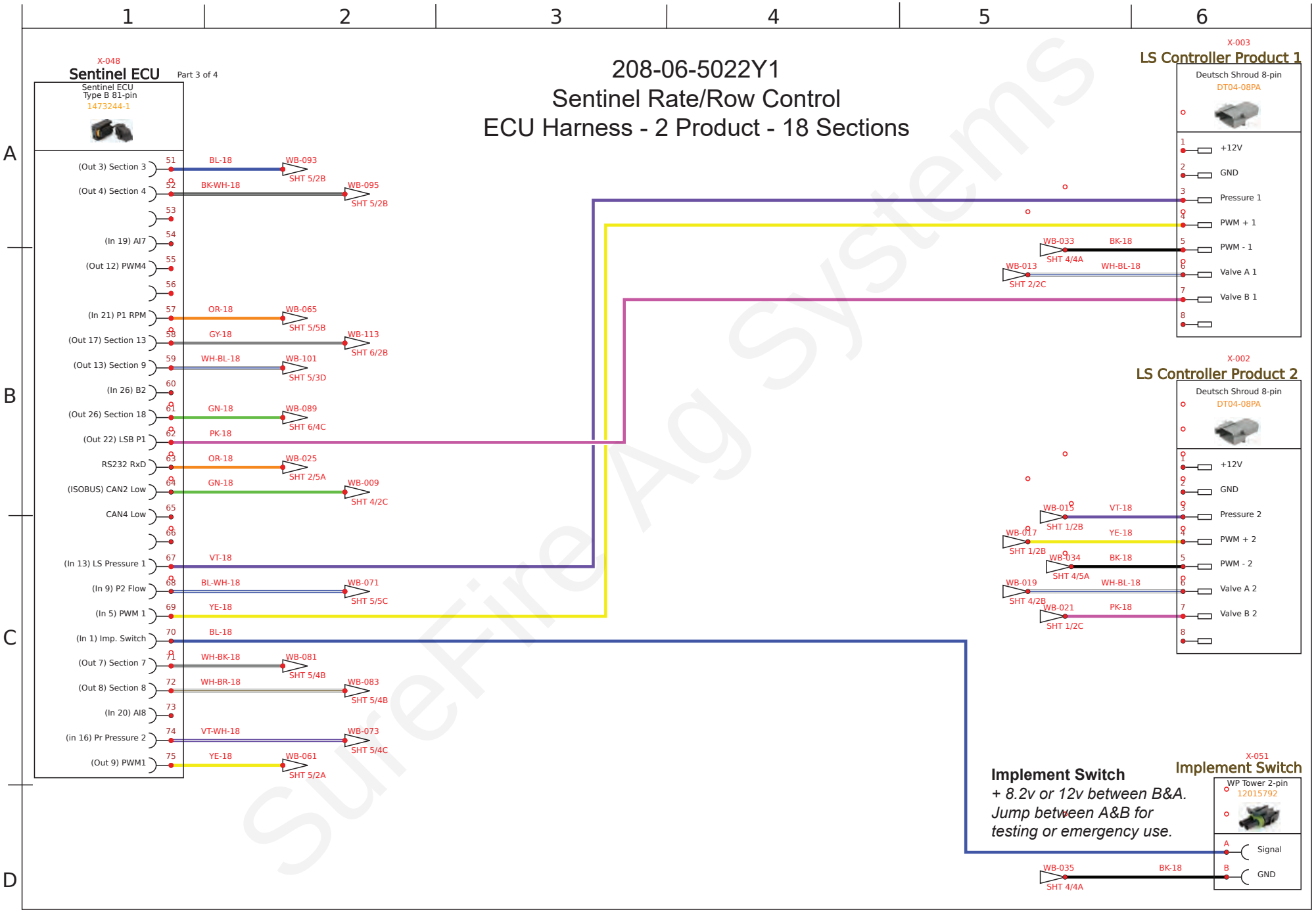


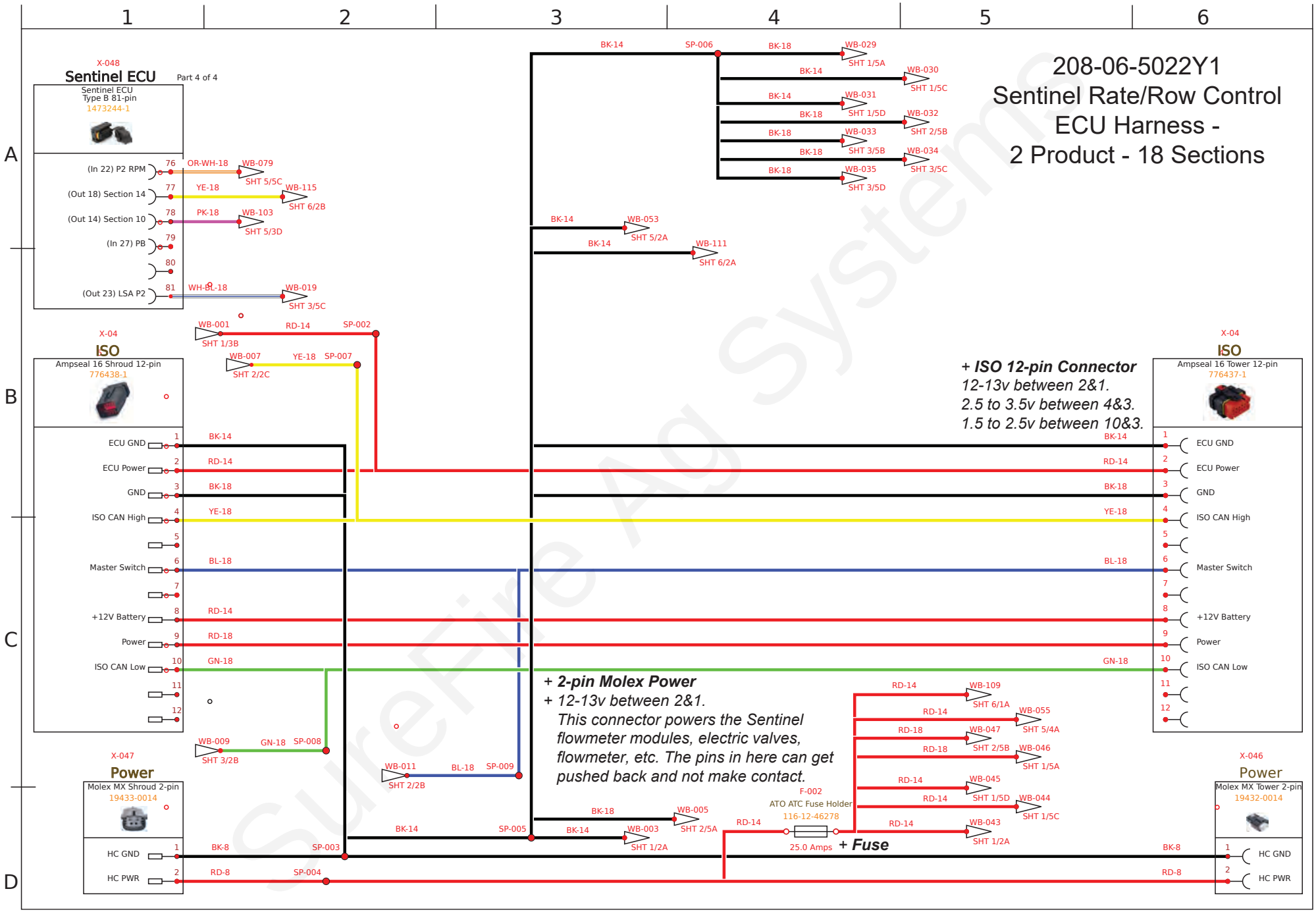


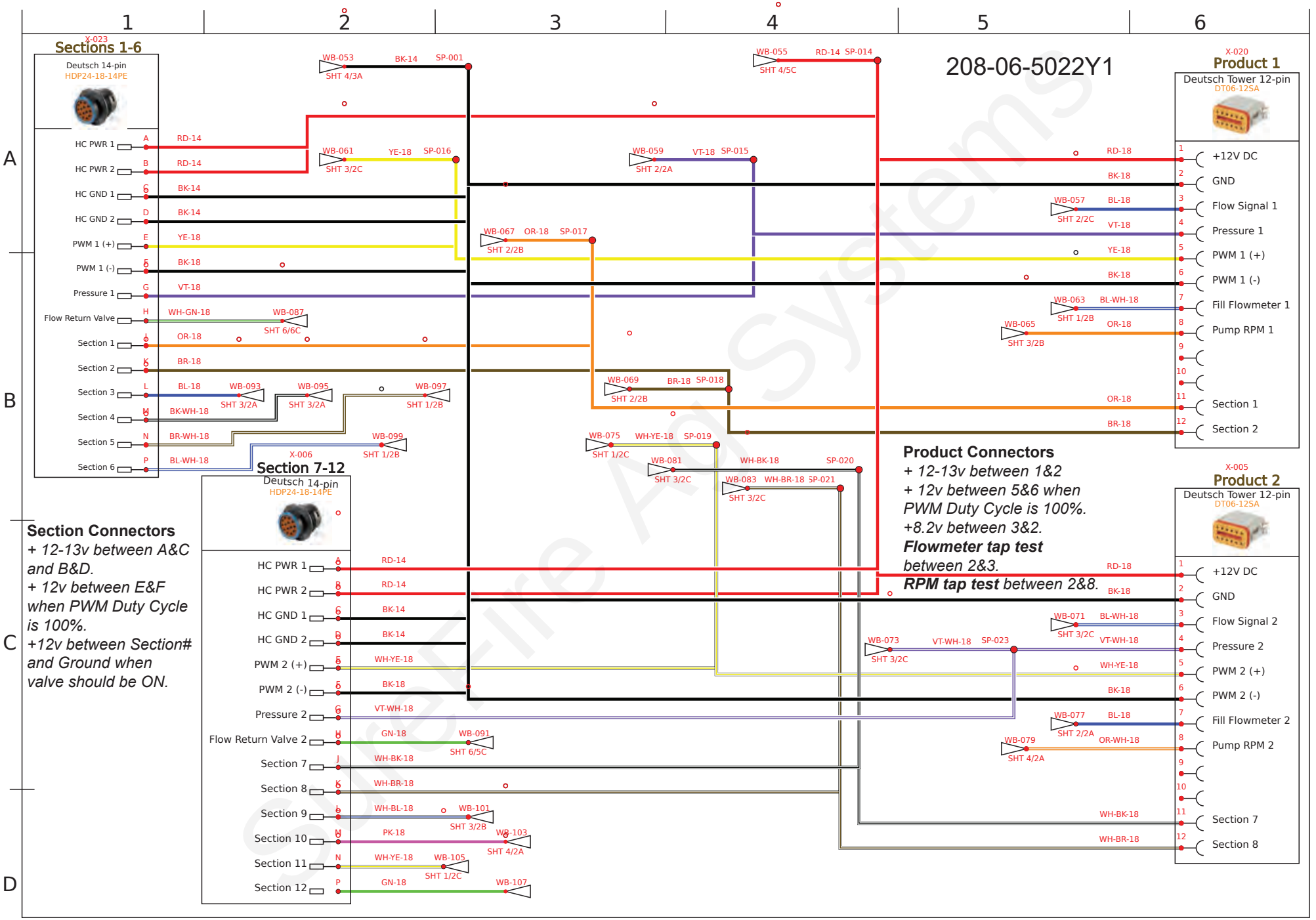

208-06-5021Y1
Sentinel ECU Harness
for Row Monitoring
X-048
Sentinel ECU Part 4 of 4
Sentinel ECU
Type B 81-pin
1473244-1
(In 22) P2 RPM
(Out 18) Section 14
(Out 14) Section 10
(In 27) PB
(Out 23) LSA P2
WH-BL-18
WB-019
SHT 3/5C
X-045
ISO
Ampseal 16 Shroud 12-pin
776438-1
ECU GND
ECU Power
GND
ISO CAN High
Master Switch
+12V Battery
Power
ISO CAN Low
X-044
ISO
Ampseal 16 Tower 12-pin
776437-1
+ ISO 12-pin Connector
12-13v between 2&1.
2.5 to 3.5v between 4&3.
1.5 to 2.5v between 10&3.
X-047
Power
Molex MX Shroud 2-pin
19433-0014
HC GND
HC PWR
+ 2-pin Molex Power
+ 12-13v between 2&1.
This connector powers the Sentinel
flowmeter modules. The pins in here can
get pushed back and not make contact.
F-002
ATO ATC Fuse Holder
116-12-46278
25.0 Amps
+ Fuse
X-046
Power
Molex MX Tower 2-pin
19432-0014
SURE FIRE AG SYSTEMS

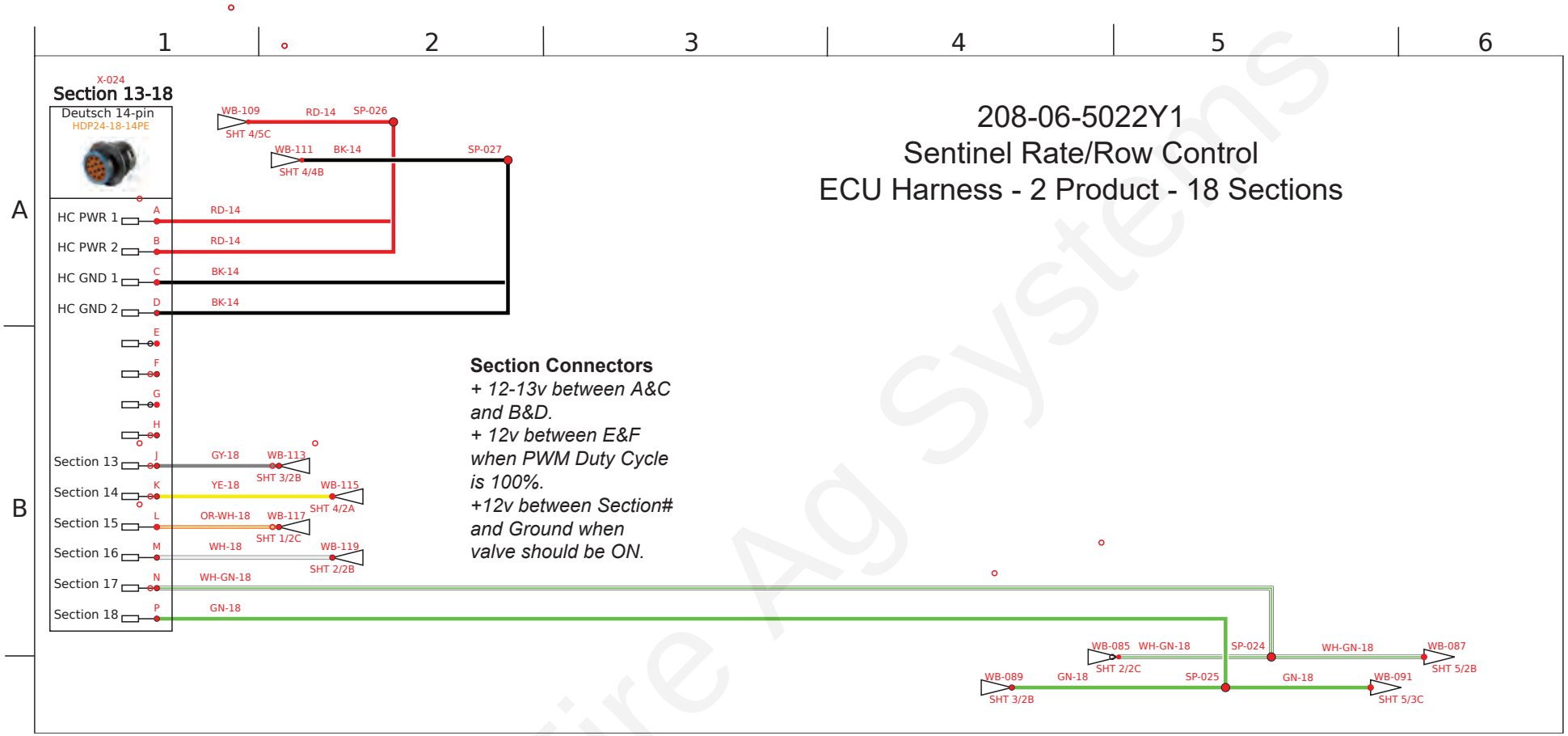


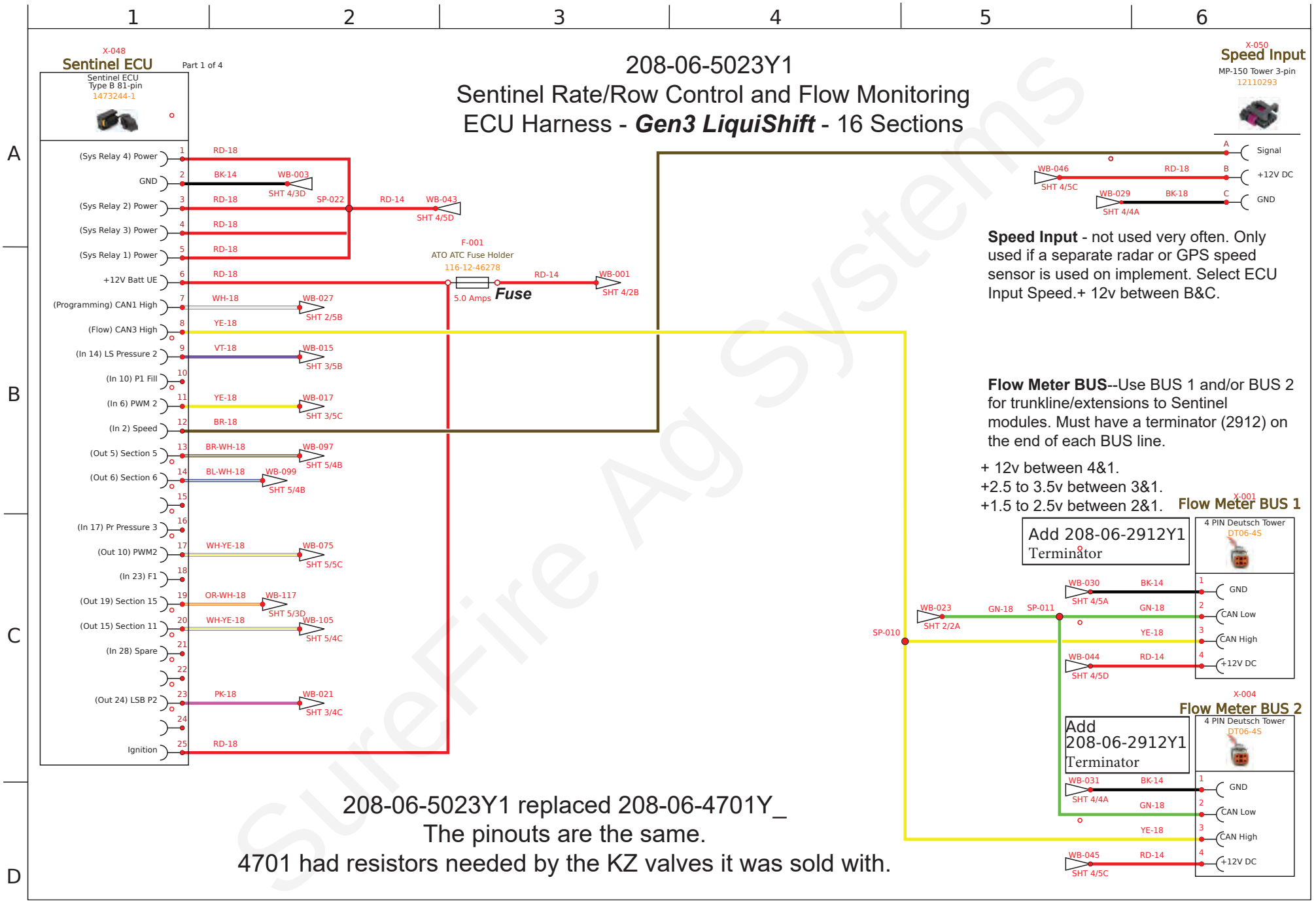


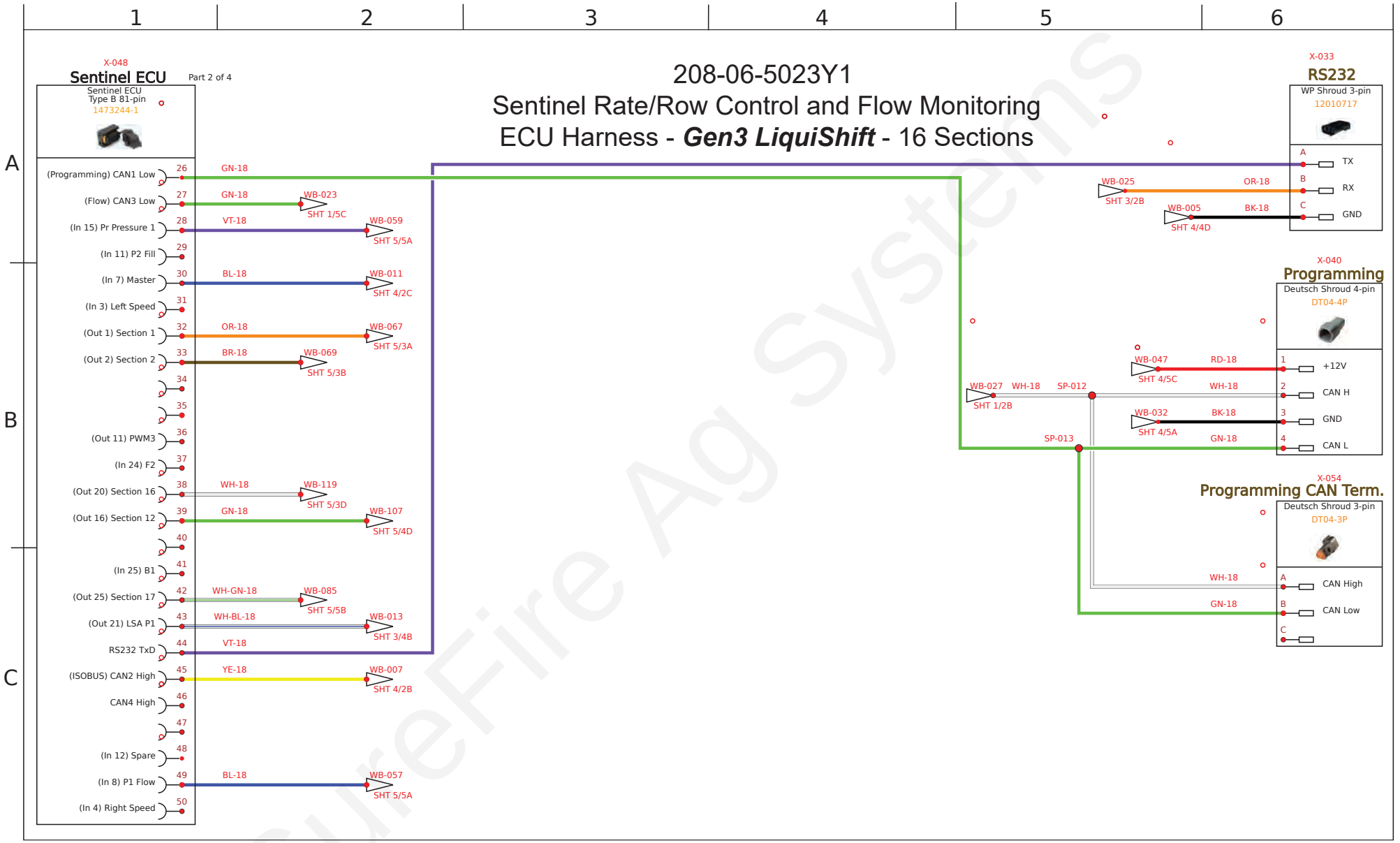


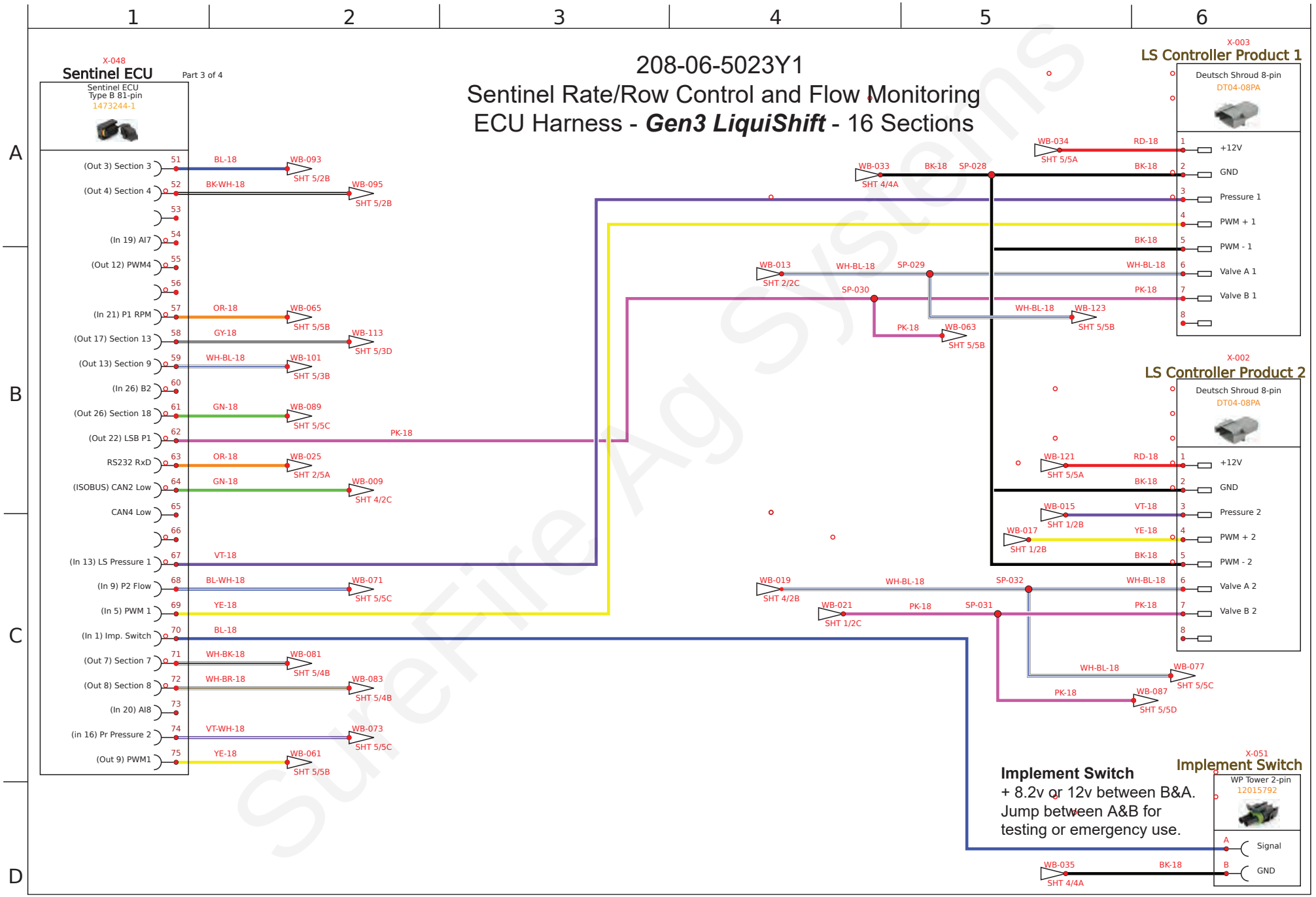


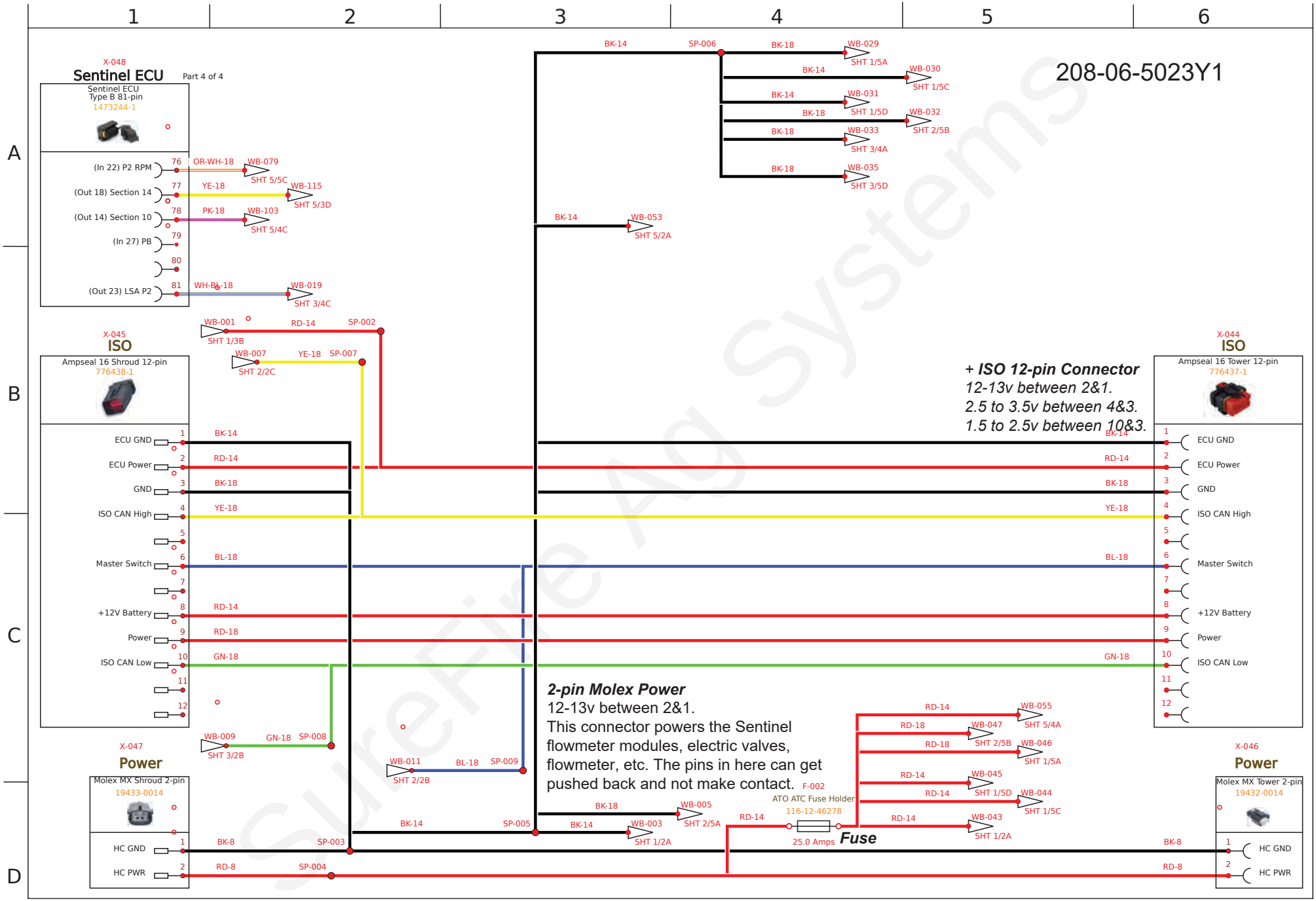

208-06-5022Y1
Sections 1-6
X-023
Deutsch 14-pin
HDP24-18-14PE
HC PWR 1
HC PWR 2
HC GND 1
HC GND 2
PWM 1 (+)
PWM 1 (-)
Pressure 1
Flow Return Valve
Section 1
Section 2
Section 3
Section 4
Section 5
Section 6
Section 7-12
X-006
Deutsch 14-pin
HDP24-18-14PE
HC PWR 1
HC PWR 2
HC GND 1
HC GND 2
PWM 2 (+)
PWM 2 (-)
Pressure 2
Flow Return Valve 2
Section 7
Section 8
Section 9
Section 10
Section 11
Section 12
Product 1
X-020
Deutsch Tower 12-pin
DT06-12SA
+12V DC
GND
Flow Signal 1
Pressure 1
PWM 1 (+)
PWM 1 (-)
Fill Flowmeter 1
Pump RPM 1
Section 1
Section 2
Product 2
X-005
Deutsch Tower 12-pin
DT06-12SA
+12V DC
GND
Flow Signal 2
Pressure 2
PWM 2 (+)
PWM 2 (-)
Fill Flowmeter 2
Pump RPM 2
Section 7
Section 8
Section Connectors
+ 12-13v between A&C and B&D.
+ 12v between E&F when PWM Duty Cycle is 100%.
+12v between Section# and Ground when valve should be ON.
Product Connectors
+ 12-13v between 1&2
+ 12v between 5&6 when PWM Duty Cycle is 100%.
+8.2v between 3&2.
Flowmeter tap test between 2&3.
RPM tap test between 2&8.
WB-053 BK-14 SP-001
SHT 4/3A
WB-055 RD-14 SP-014
SHT 4/5C
WB-061 YE-18 SP-016
SHT 3/2C
WB-059 VT-18 SP-015
SHT 2/2A
WB-067 OR-18 SP-017
SHT 2/2B
WB-057 BL-18
SHT 2/2C
WB-063 BL-WH-18
SHT 1/2B
WB-065
SHT 3/2B
WB-069 BR-18 SP-018
SHT 2/2B
WB-075 WH-YE-18 SP-019
SHT 1/2C
WB-081
SHT 3/2C
WB-083 WH-BR-18 SP-021
SHT 3/2C
WB-073 VT-WH-18 SP-023
SHT 3/2C
WB-071 BL-WH-18
SHT 3/2C
WB-077 BL-18
SHT 2/2A
WB-079
SHT 4/2A
WB-087
SHT 6/6C
WB-093
SHT 3/2A
WB-095
SHT 3/2A
WB-097
SHT 1/2B
WB-099
SHT 1/2B
WB-091
SHT 6/5C
WB-101
SHT 3/2B
WB-103
SHT 4/2A
WB-105
SHT 1/2C
WB-107
RD-18
BK-18
VT-18
YE-18
OR-18
BR-18
WH-BK-18
WH-BR-18
WH-YE-18
VT-WH-18
BL-WH-18
OR-WH-18
RD-14
BK-14
WH-GN-18
BK-WH-18
BR-WH-18
BL-WH-18
GN-18
PK-18
Super-Fire Art Systems

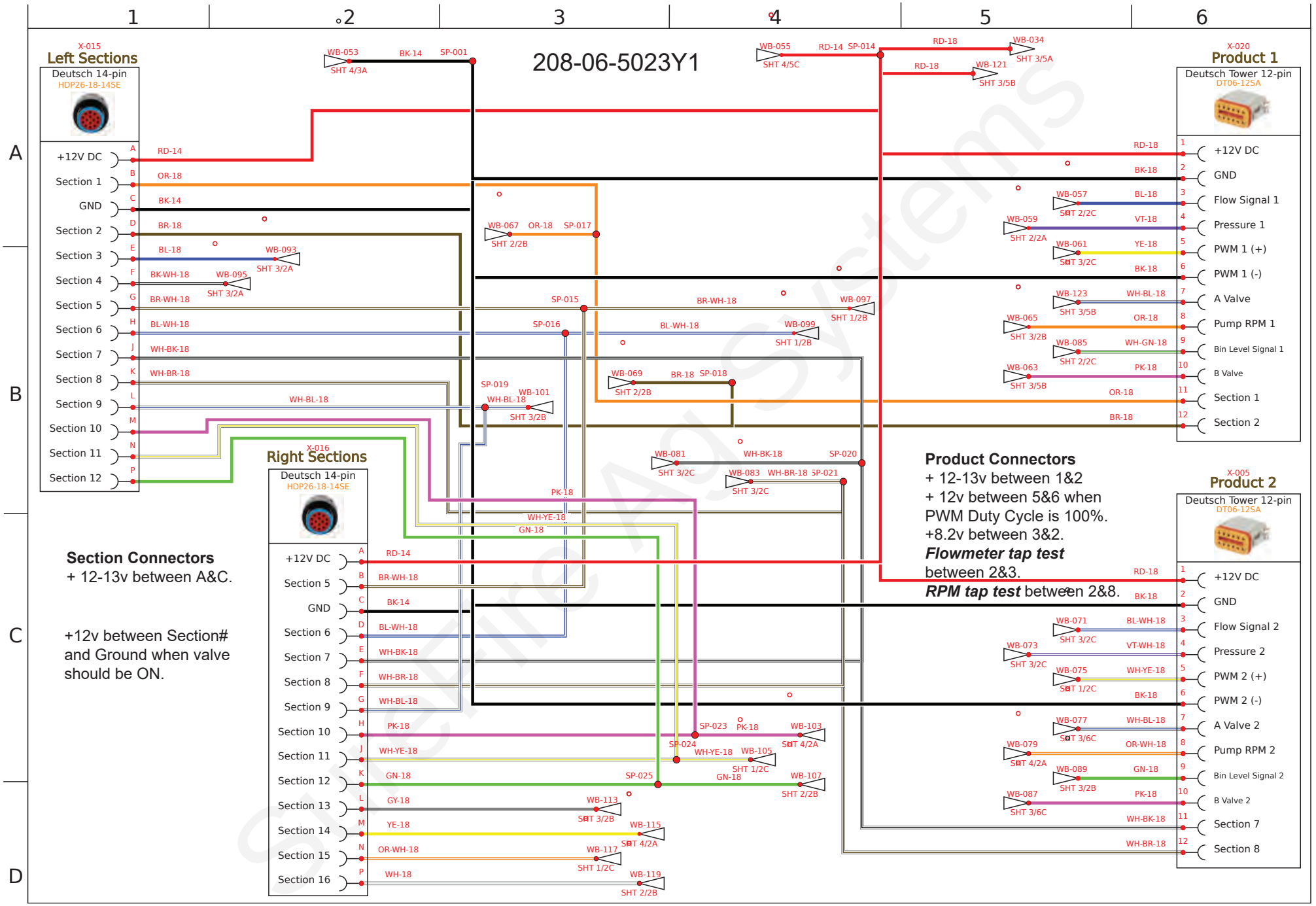



208-06-5023Y1
Sentinel Rate/Row Control and Flow Monitoring
ECU Harness - Gen3 LiquiShift - 16 Sections
X-048
Sentinel ECU
Part 1 of 4
Sentinel ECU
Type B 81-pin
1473244-1
(Sys Relay 4) Power
GND
(Sys Relay 2) Power
(Sys Relay 3) Power
(Sys Relay 1) Power
+12V Batt UE
(Programming) CAN1 High
(Flow) CAN3 High
(In 14) LS Pressure 2
(In 10) P1 Fill
(In 6) PWM 2
(In 2) Speed
(Out 5) Section 5
(Out 6) Section 6
(In 17) Pr Pressure 3
(Out 10) PWM2
(In 23) F1
(Out 19) Section 15
(Out 15) Section 11
(In 28) Spare
(Out 24) LSB P2
Ignition
RD-18
BK-14
WB-003
SHT 4/3D
SP-022
RD-14
WB-043
SHT 4/5D
F-001
ATO ATC Fuse Holder
116-12-46278
5.0 Amps Fuse
WB-001
SHT 4/2B
WH-18
WB-027
SHT 2/5B
YE-18
VT-18
WB-015
SHT 3/5B
WB-017
SHT 3/5C
BR-18
BR-WH-18
WB-097
SHT 5/4B
BL-WH-18
WB-099
SHT 5/4B
WH-YE-18
WB-075
SHT 5/5C
OR-WH-18
WB-117
SHT 5/3D
WB-105
SHT 5/4C
PK-18
WB-021
SHT 3/4C
X-050
Speed Input
MP-150 Tower 3-pin
12110293
A
Signal
B
+12V DC
C
GND
WB-046
SHT 4/5C
WB-029
SHT 4/4A
Speed Input - not used very often. Only used if a separate radar or GPS speed sensor is used on implement. Select ECU Input Speed.+ 12v between B&C.
Flow Meter BUS--Use BUS 1 and/or BUS 2 for trunkline/extensions to Sentinel modules. Must have a terminator (2912) on the end of each BUS line.
+ 12v between 4&1.
+2.5 to 3.5v between 3&1.
+1.5 to 2.5v between 2&1.
X-001
Flow Meter BUS 1
4 PIN Deutsch Tower
DT06-4S
Add 208-06-2912Y1 Terminator
WB-030
SHT 4/5A
WB-023
SHT 2/2A
SP-010
SP-011
WB-044
SHT 4/5D
X-004
Flow Meter BUS 2
Add 208-06-2912Y1 Terminator
WB-031
SHT 4/4A
WB-045
SHT 4/5C
208-06-5023Y1 replaced 208-06-4701Y_
The pinouts are the same.
4701 had resistors needed by the KZ valves it was sold with.
SureFire Ag Systems



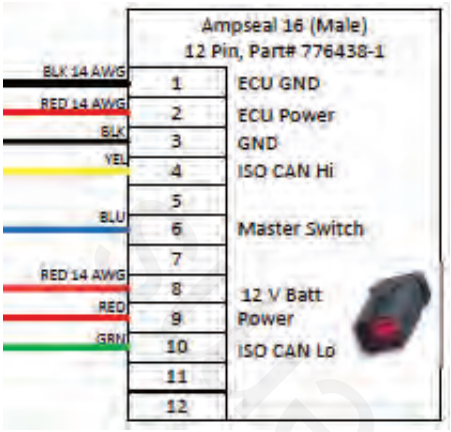



208-06-5023Y1
X-048
Sentinel ECU
Part 4 of 4
Sentinel ECU
Type B 81-pin
1473244-1
(In 22) P2 RPM
(Out 18) Section 14
(Out 14) Section 10
(In 27) PB
(Out 23) LSA P2
OR-WH-18
YE-18
PK-18
WH-BL-18
WB-079
SHT 5/5C
WB-115
SHT 5/3D
WB-103
SHT 5/4C
WB-019
SHT 3/4C
BK-14
SP-006
BK-18
WB-029
SHT 1/5A
WB-030
SHT 1/5C
WB-031
SHT 1/5D
WB-032
SHT 2/5B
WB-033
SHT 3/4A
WB-035
SHT 3/5D
WB-053
SHT 5/2A
X-045
ISO
Ampseal 16 Shroud 12-pin
776438-1
WB-001
SHT 1/3B
RD-14
SP-002
WB-007
SHT 2/2C
YE-18
SP-007
ECU GND
ECU Power
GND
ISO CAN High
Master Switch
+12V Battery
Power
ISO CAN Low
BK-14
RD-14
BK-18
YE-18
BL-18
RD-18
GN-18
X-044
ISO
Ampseal 16 Tower 12-pin
776437-1
+ ISO 12-pin Connector
12-13v between 2&1.
2.5 to 3.5v between 4&3.
1.5 to 2.5v between 10&3.
X-047
Power
Molex MX Shroud 2-pin
19433-0014
WB-009
SHT 3/2B
GN-18
SP-008
WB-011
SHT 2/2B
BL-18
SP-009
2-pin Molex Power
12-13v between 2&1.
This connector powers the Sentinel flowmeter modules, electric valves, flowmeter, etc. The pins in here can get pushed back and not make contact.
BK-14
SP-005
WB-005
SHT 2/5A
WB-003
SHT 1/2A
F-002
ATO ATC Fuse Holder
116-12-46278
25.0 Amps
Fuse
RD-14
WB-055
SHT 5/4A
WB-047
SHT 2/5B
WB-046
SHT 1/5A
WB-045
SHT 1/5D
WB-044
SHT 1/5C
WB-043
SHT 1/2A
X-046
Power
Molex MX Tower 2-pin
19432-0014
HC GND
HC PWR
BK-8
RD-8
SP-003
SP-004
SureFire Ag Systems

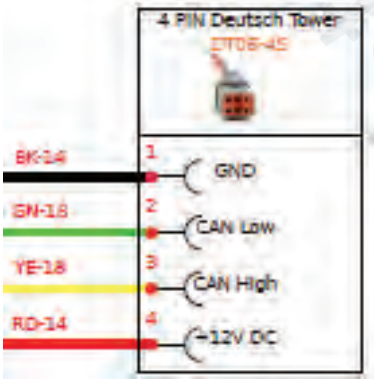

208-06-5023Y1
X-015
Left Sections
Deutsch 14-pin
HDP26-18-14SE
+12V DC
Section 1
GND
Section 2
Section 3
Section 4
Section 5
Section 6
Section 7
Section 8
Section 9
Section 10
Section 11
Section 12
X-016
Right Sections
Deutsch 14-pin
HDP26-18-14SE
+12V DC
Section 5
GND
Section 6
Section 7
Section 8
Section 9
Section 10
Section 11
Section 12
Section 13
Section 14
Section 15
Section 16
X-020
Product 1
Deutsch Tower 12-pin
DT06-12SA
+12V DC
GND
Flow Signal 1
Pressure 1
PWM 1 (+)
PWM 1 (-)
A Valve
Pump RPM 1
Bin Level Signal 1
B Valve
Section 1
Section 2
X-005
Product 2
Deutsch Tower 12-pin
DT06-12SA
+12V DC
GND
Flow Signal 2
Pressure 2
PWM 2 (+)
PWM 2 (-)
A Valve 2
Pump RPM 2
Bin Level Signal 2
B Valve 2
Section 7
Section 8
Section Connectors
+ 12-13v between A&C.
+12v between Section# and Ground when valve should be ON.
Product Connectors
+ 12-13v between 1&2
+ 12v between 5&6 when PWM Duty Cycle is 100%.
+8.2v between 3&2.
Flowmeter tap test between 2&3.
RPM tap test between 2&8.
Sure-Fire Ag Systems

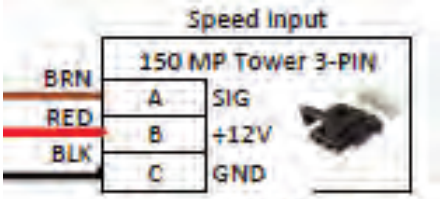
208-06-5022Y1 Connector pinouts for Rate Control and Row Control

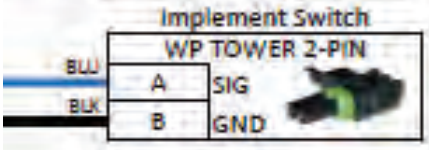
ISO Connector - 12-pin



Flowmeter Bus 1 & 2

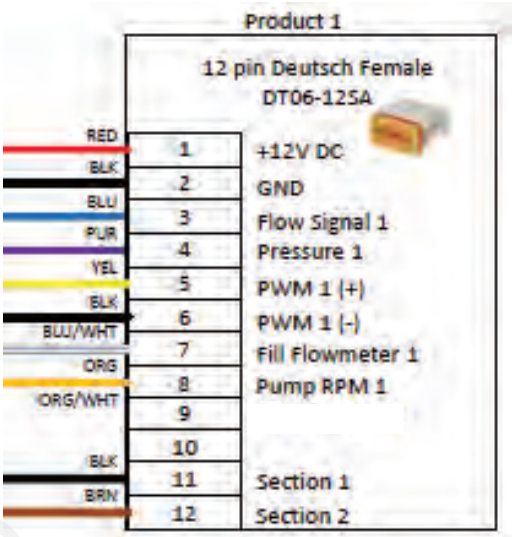


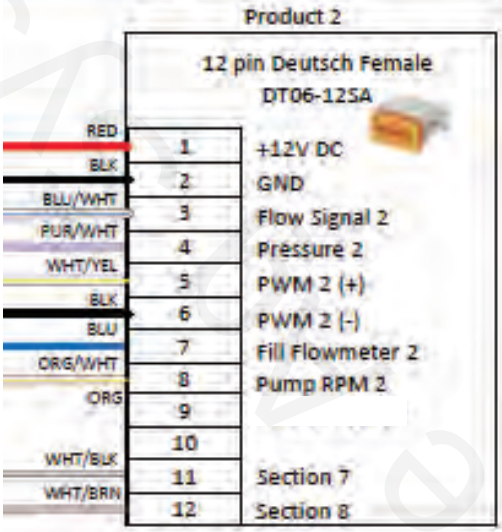


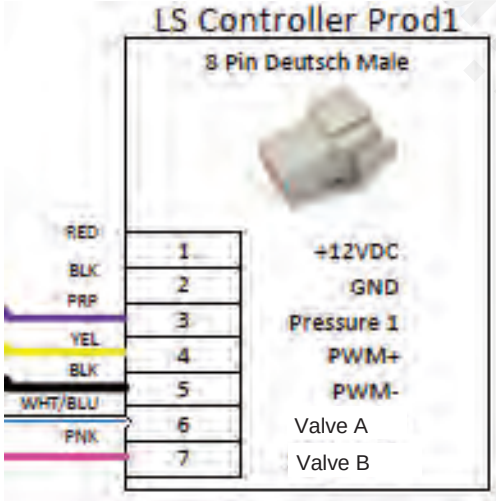


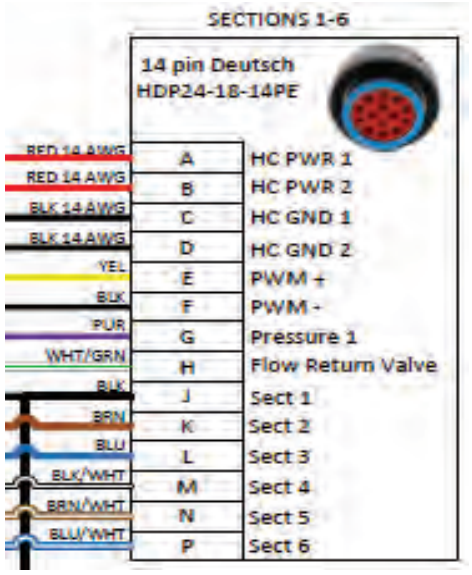
General Diagnostic Tips

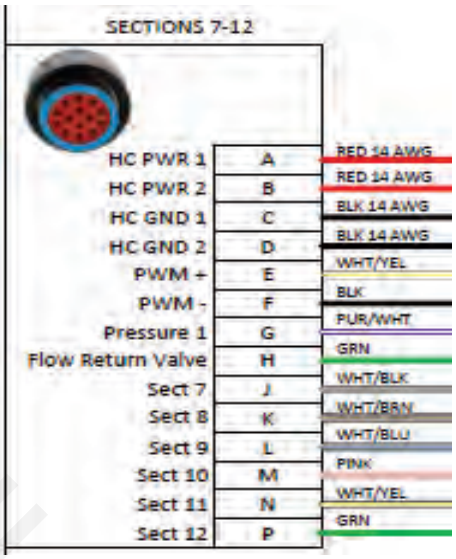
+12

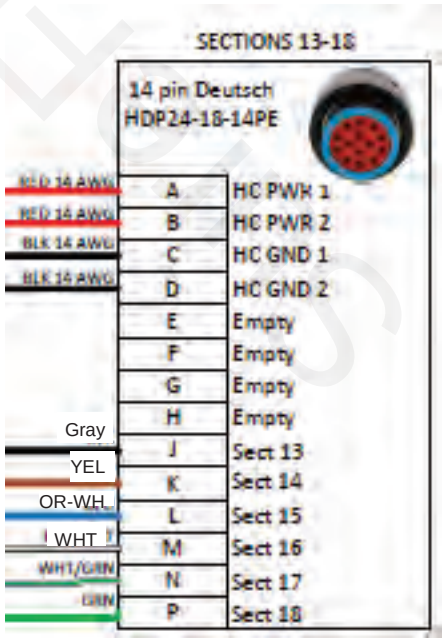






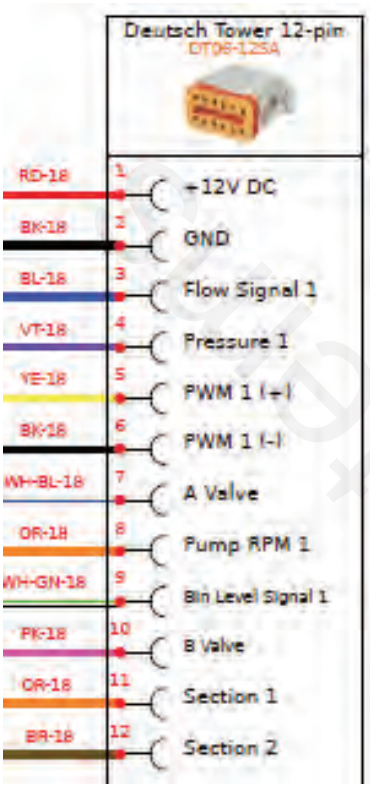




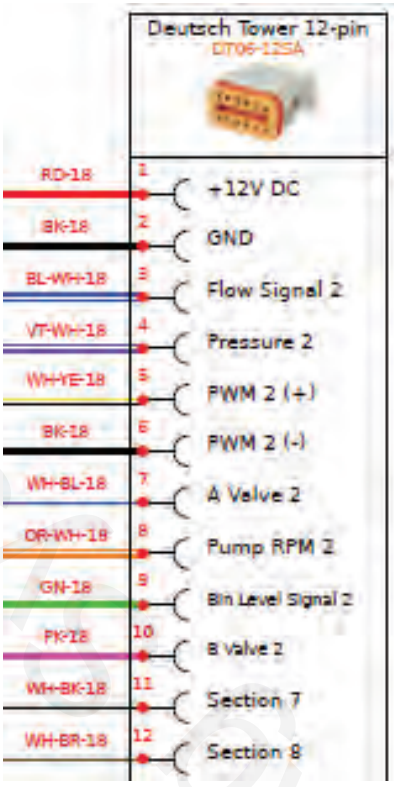


208-06-5023Y1 Connector pinouts for Gen3 LiquiShift Rate Control

Product 1

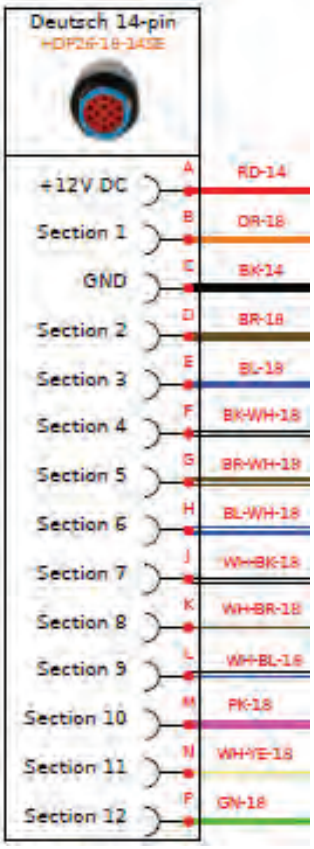


Product 2

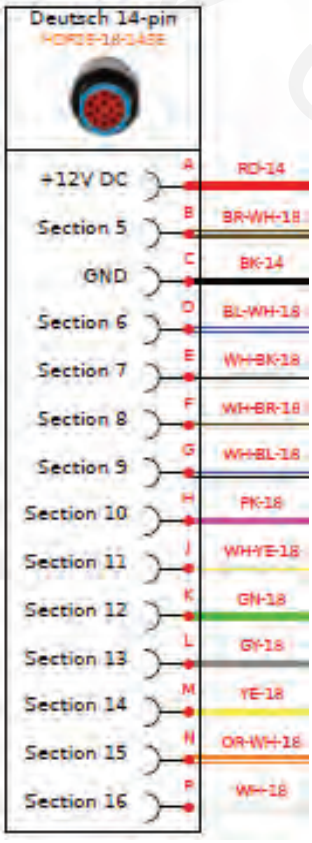


The connectors not shown here are the same as on the 5022 harness on the previous page.

Left Sections



Right Sections

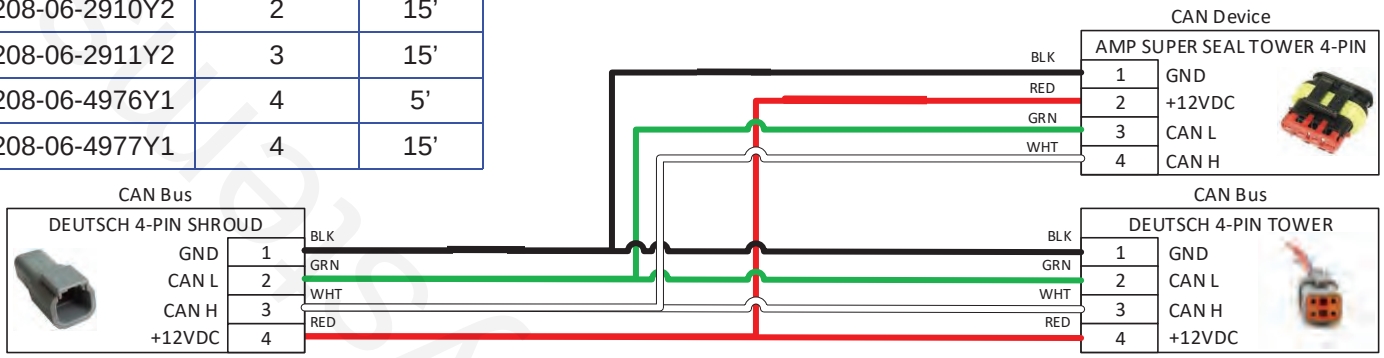


4-Pin Deutsch CAN Trunklines to 4-Pin AMP SuperSeal to connect Sentinel Flowmeter Modules

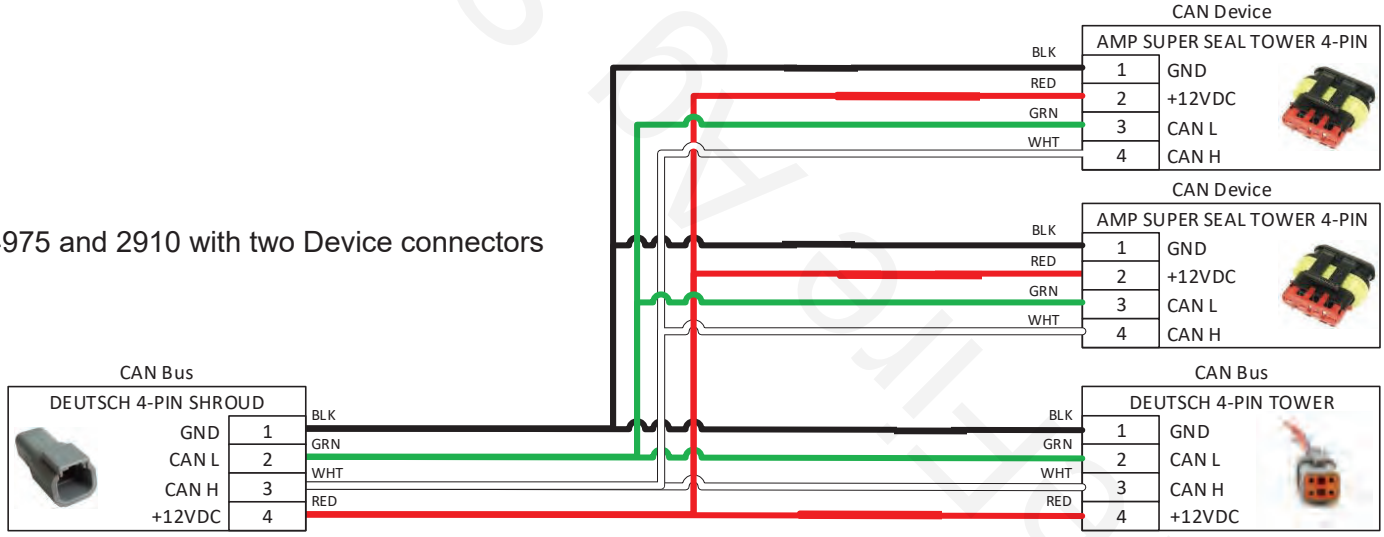
Part #	Number of flowmeter connectors	Length
208-06-2908Y2	1	5’
208-06-2909Y2	1	15’
208-06-4975Y1	2	5’
208-06-2910Y2	2	15’
208-06-2911Y2	3	15’
208-06-4976Y1	4	5’
208-06-4977Y1	4	15’

CAN Device
+ 12v between 2&1.
1.5 to 2.5 v between 3&1.
+2.5 to 3.5v between 4&1.

2908 and 2909 with one Device connector



4975 and 2910 with two Device connectors



CAN Bus
+ 12v between 4&1.
+2.5 to 3.5v between 3&1.
+1.5 to 2.5v between 2&1.

2911 is similar to the above, but with three Device connectors.

4976 and 4977 are similar to the above, but with four Device connectors.

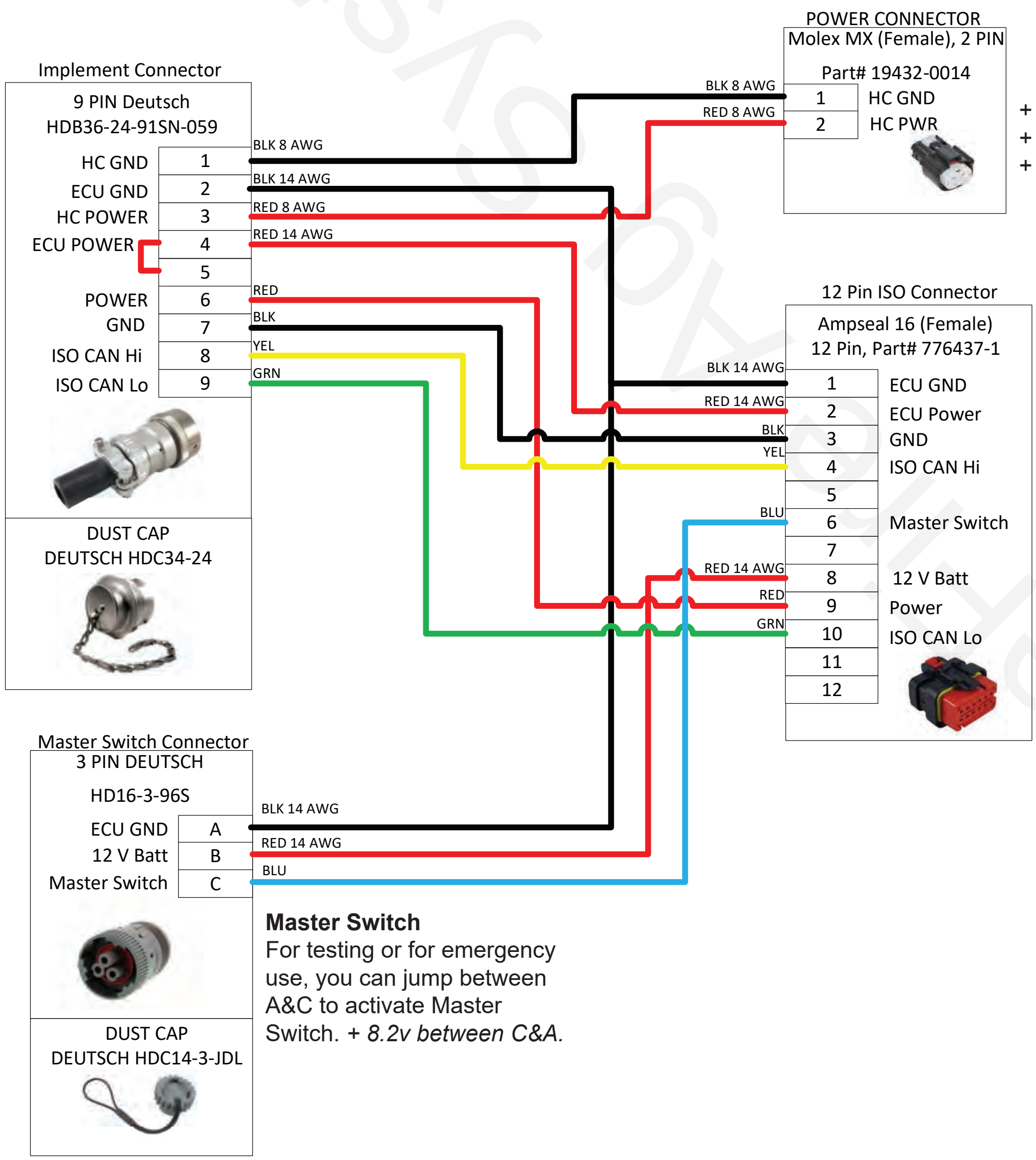
The Deutsch 4-pin Tower CAN Bus connector (bottom right of each drawing above) is plugged into another trunkline or, if it is the last trunkline, it is plugged into a Terminator.

214-00-3553Y1 Thru 214-00-3557Y1

Front Extension Harness – (9-Pin ISO Connector w/ 3-Pin Master Switch & 12-Pin ISO and 2-Pin Molex Power)

Wire 18AWG unless otherwise specified

+ ***Use this for troubleshooting harnessing, voltage, or communication issues. Some issues may need to be traced back to the 9-pin ISO connector. There is a fuse between the 9-pin ISO connector on the back of the tractor and the battery.***



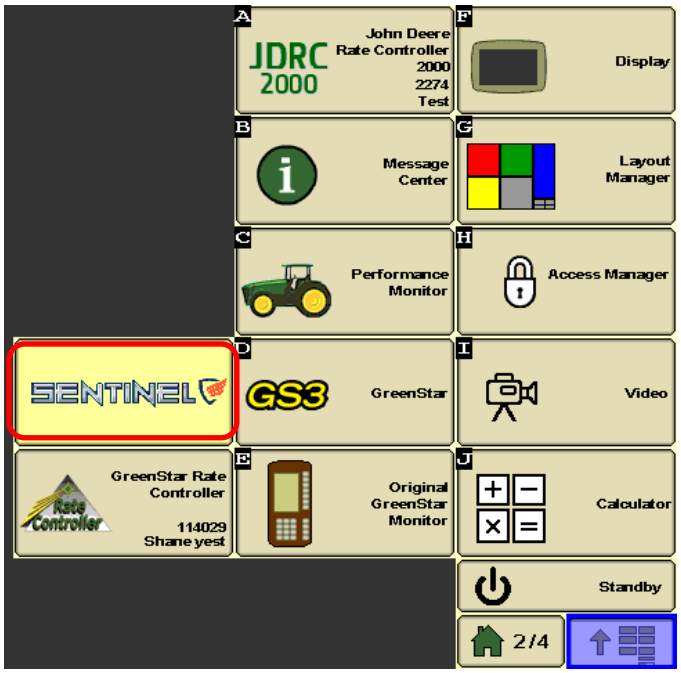
+ ***2-pin Molex Power***
+ *12-13v between 2&1.*
+ *The pins in here can get pushed back and not make contact.*

12-pin ISO connector
+ *12-13v between 2&1*
12-13 v between 9&3
2.5-3.5v between 4&3
1.5-2.5v between 10&3

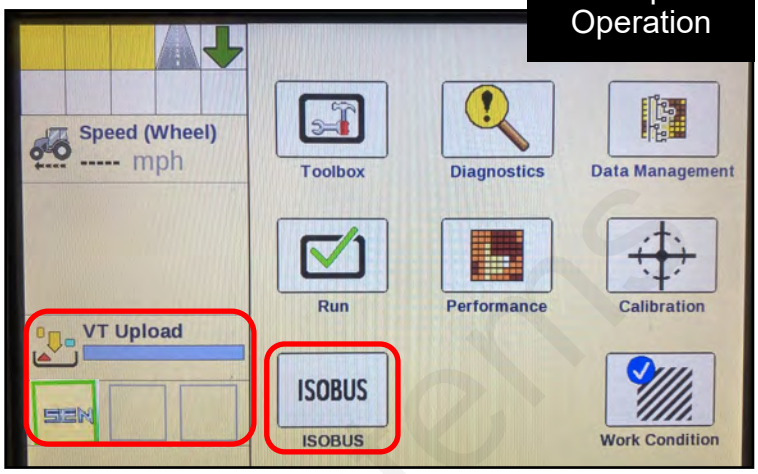
Master Switch
For testing or for emergency use, you can jump between A&C to activate Master Switch. + *8.2v between C&A.*

How to get to Sentinel on the VT (or UT)

John Deere 2630 Display



Pro 700 Display

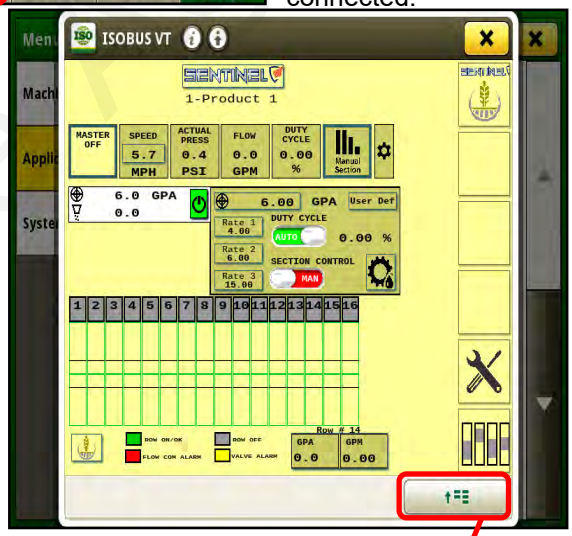


You can set up VT Upload and VT Implements on Toolbox > Layout (shown in Left Area above). On first bootup, VT Upload may take several minutes for a new device.

Press ISOBUS to go to ISOBUS devices or Press the Sentinel icon to go to the Sentinel screens.

John Deere 4640 Gen 4 Display

PRESS “ISO” to go to the ISOBUS VT screens. There may be more than one ISOBUS device connected.



ISOBUS VT Menu

There may be more than one ISOBUS device connected.

How to get to Sentinel on the VT (or UT)

Ag Leader InCommand

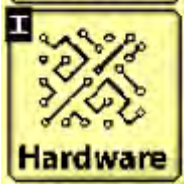
Trimble TMX-2050

Icons from Sentinel

Sentinel Wheat "HOME" button - returns to the main run screen.

IMPLEMENT Setup -enter implement geometry

SPEED Setup - select speed source and see which speed sources are reporting speed.



HARDWARE - set up height switch, master switch, task control, Intellisection

RATE Setup - set up rate mode, target rate, rate smoothing

SETTINGS tools - set up products, devices, rows, sections

ROW BAR - see Sentinel row graphs depicting the flow on each row

SureFire - see software version. Go to Auxiliary Settings screen.

Next VT - when more than one display is in use, this moves the Sentinel to the next screen. (v.1.3.0)

Save to this VT - when more than one display is available. (v.1.3.0)

Nozzle Test - Run a test with a simulated speed and target rate. (v.1.3.0)

Catch Test - check and adjust flowmeter calibration. (v.1.3.0)

Save Task Controller settings

LiquiShift - this icon will be available when Sentinel is controlling the LiquiShift valves.

Setting Up

Sentinel Row Monitoring

With Sentinel Flowmeters

226-01-3547Y1
Sentinel ISOBUS ECU

OR

226-01-5319Y1
3CS Row Monitoring
Sentinel ISOBUS ECU

Typically will use one of the following Sentinel ECU Harnesses

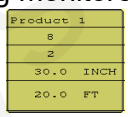
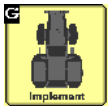
208-06-5021Y1	Sentinel ECU Harness		208-06-5374Y1	Sentinel Lvl 1 Monitor Only
208-06-3536Y3	Sentinel ECU Harness			

Sentinel Setup and Configuration
Set-up and Configuration for Row Monitoring

The following pages will guide you through the initial set-up and configuration of your Sentinel Row Monitoring system. Below is an overview of the steps necessary to fully configure the system before operation. Each subsequent page outlines the page features as well as the sequence of buttons used to navigate to that page from the HOME screen.

Basic Steps for Initial System Set-up for Row Monitoring

For detailed information on a step, go to the referenced page

REFERENCE Page #	STEP
	1. Press the **HOME** button 
34	2. Go to the settings page by touching the **SETTINGS** button 
34	3. On the settings page, specify the number of products being monitored (maximum of 4)
34-35	4. Configure each product by touching the **PRODUCT** button 
34-35	5. Select **DEVICE** *(Liquid Row Monitor)* and set up each product with requested information.
35	6. Press **MORE**, set up Rate (AVG), Smoothing (10%), other options for this setup.
35	7. When finished, use the BACK arrow to go back to the SETTINGS menu.
36	8. Set up the implement dimensions by touching the I**MPLEMENT** button. 
36	9. Choose a speed source by selecting the **SPEED** button. 
36	10. Select system control options (task control, lift switch, etc.) under **HARDWARE.** 
37	11. Select the Rate Mode (*AVG)* at **RATE SETUP.** 
38	12. From the Settings screen, touch the **NEXT** button. 
38	13. Click on **Flow Module Diagnostics**
38	14. Ensure that all flow modules are plugged in and click **Reset All Addresses**
	15. Unplug all of the Sentinel Flowmeter Modules.
	16. Beginning with module #1 (on Product 1), plug it back in - module 1 should turn green on the screen. Have someone watch the screen to verify successful addressing for each module.
	17. Moving across the implement, plug in each module for Product 1 in order.
	18. If applicable, address the modules for product 2 by repeating steps 15-16 for product 2.
	19. Select the correct module orientation (**ABCD** or **DCBA**) (What is Row 1? (A) or (D)?
39	20. Customizing Scans and Alarms
40-41	21. Row Detail Screen and Operation

Sentinel Setup and Configuration
Home Screen Navigation for Row Monitoring

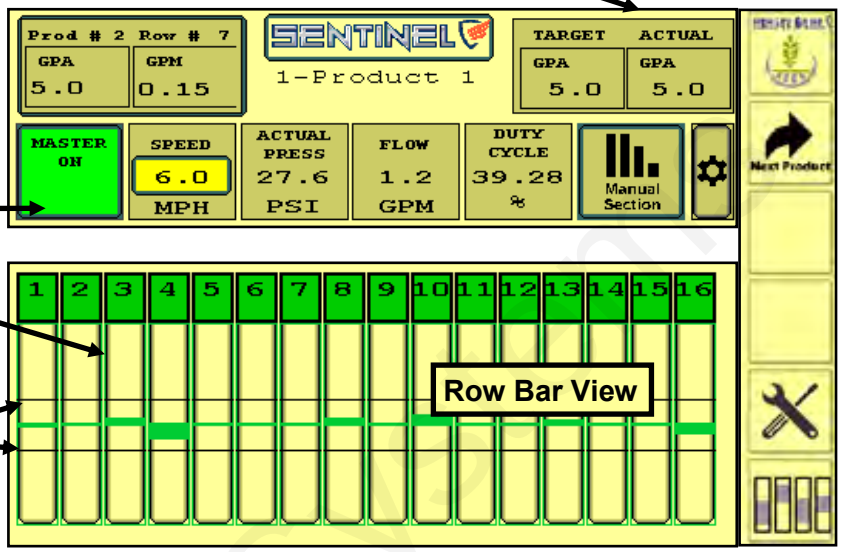
Real-time, implement-wide performance is displayed here as both target rate and actual rate

If an implement height switch is plugged into the Sentinel harnessing, there is an arrow showing the current implement height status.

The Row Bar View provides a quick visual reference of total system performance as well as individual row flow.

The black bars represent the user-defined row-flow ***tolerance*** above and below the current flow

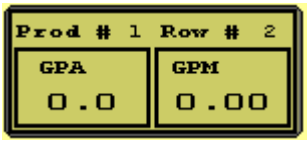
Sentinel HOME Screen



Row Bar Button

The SENTINEL ROW BAR button appears when using row flow monitoring. When doing row flow monitoring, this takes you to the row bar view page (above). This button may appear on the right side of the screen or on bottom left, where it puts the Row Bar View on the bottom half of the screen.

Row Detail Button



Touching the **ROW DETAIL** button will display individual row details including individual row flow, rate, module temperature, voltage, etc. (see page 24) To change the row that is being displayed in this button, touch the row on the flow chart. (see pg. 24)

Screen Settings Button

Touching this button will allow you to set up the icons on this row. When you press this button you will see three rows of icons. The top row shows what is on your screen now. To change an icon, press on that icon on the top row and then press on the icon you want there on the 2nd or 3rd row. Click OK.

Next Product Button

Toggle between up to 4 product screens (Liquid Row Flow Monitoring) or 2 products (Rate Control) by touching the **NEXT PRODUCT** button.

Settings (Tools) Button

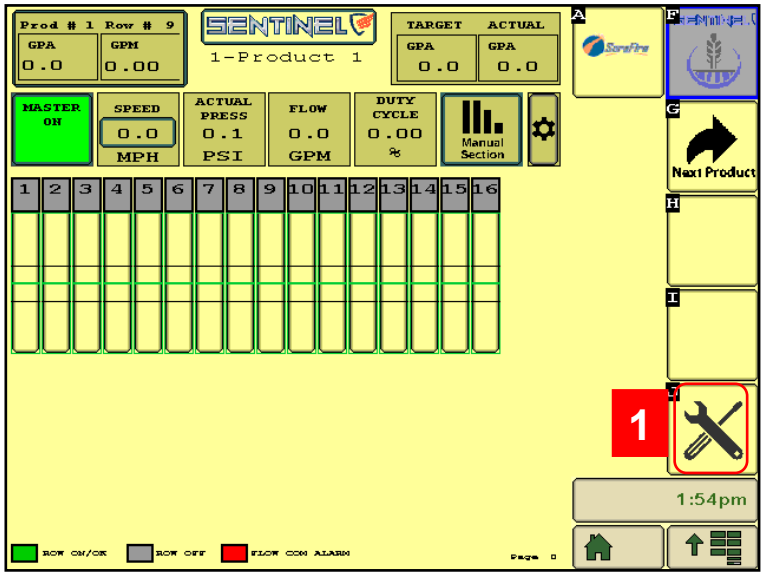
The **SETTINGS** button will be used to access the system configuration pages and to change individual product alarm, tolerance, and rate settings. (see next page)

Master (ON/OFF) Button

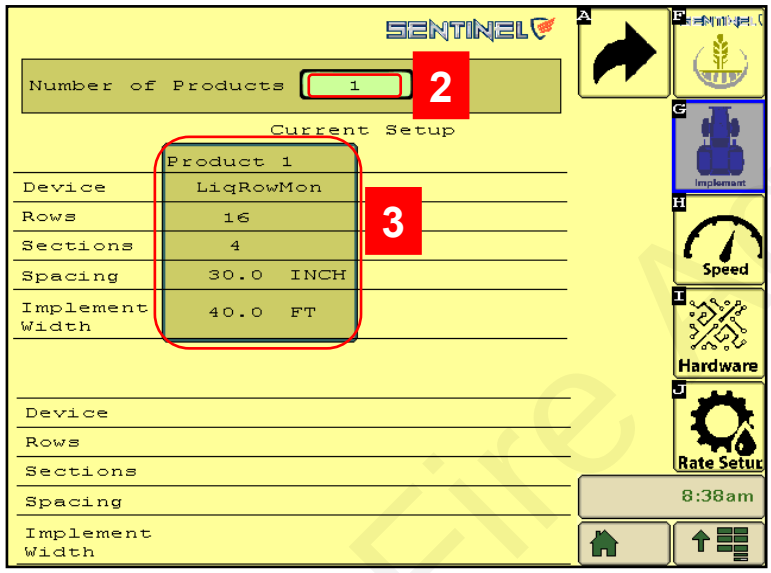
The **MASTER ON/OFF** button enables and disables the Sentinel system. *This must be **GREEN (MASTER ON)** for Sentinel to work.*

ARROW indicates implement position when using Implement Switch with Sentinel

SETUP for Row Flow Monitoring - Settings - Product - Device



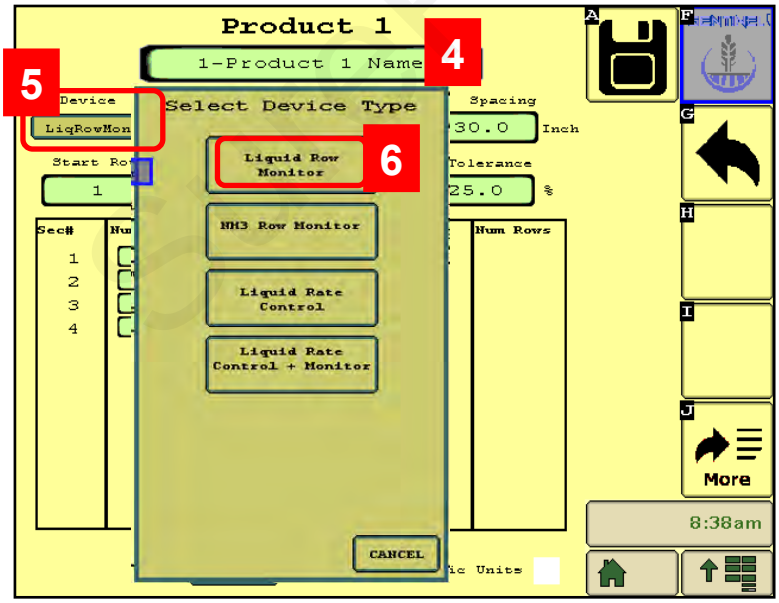
1.) Press the **SETTINGS** Tools button to go to the System Configuration screens.



2.) Enter the **number of products** that will be monitored or controlled with the Sentinel.

3.) Press the big **Product 1** box.

(If the system has two products, there will be a Product 2 box to the right of Product 1. Set up Product 2 in a similar fashion to what is shown for Product 1.)

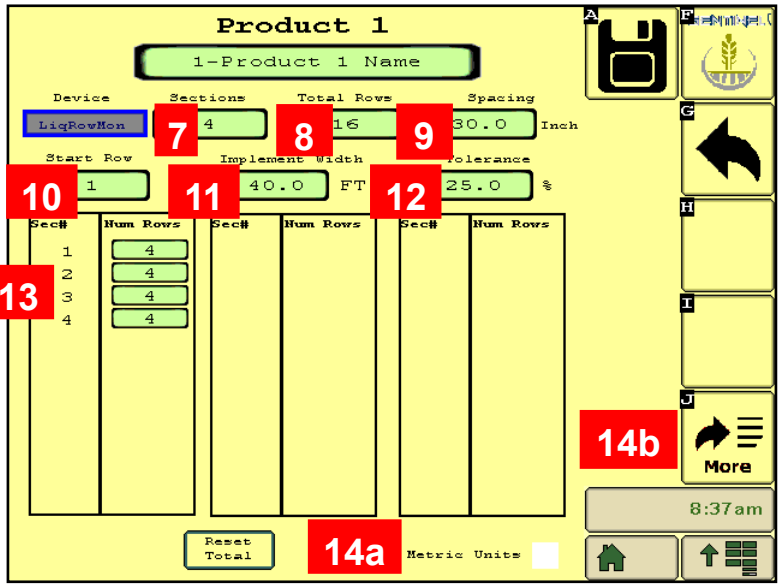


4.) Enter a name for the Product.

5.) Press the box under "**Device**".

6.) Select "**Liquid Row Monitor**" to use the Sentinel flowmeter modules for row flow monitoring.

SETUP for Row Flow Monitoring - Sections - Rows - Tolerance - Rates - Smoothing - LiquiShift Enable



14a.) Check this box for **Metric Units**.

7.) Enter the number of **SECTIONS** for this product.

8.) Enter the number of **ROWS** for this product.

9.) Enter the row spacing in **INCHES**.

10.) **Start Row** = 1 for Product 1.

Product 2 Start Row will typically be 1 more than the number of Rows on Product 1. On a 16-row system, Product 2 will start with Row 17.

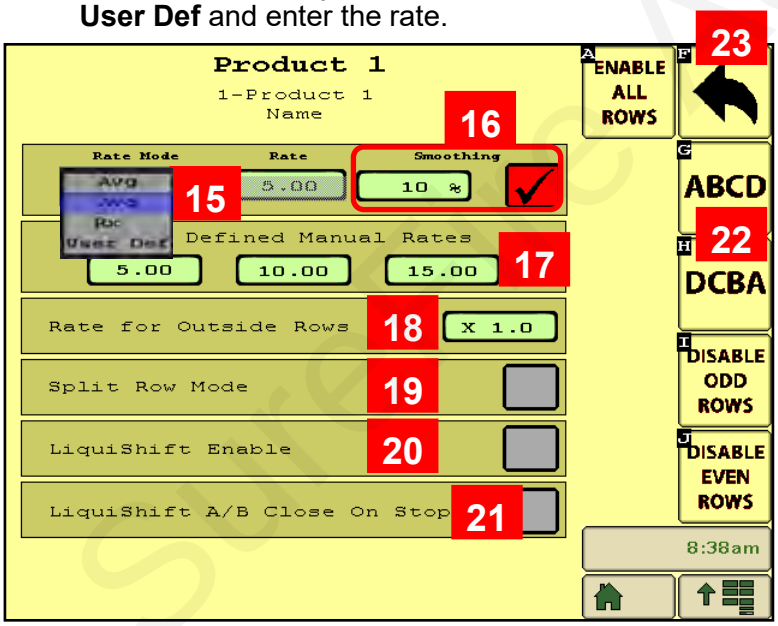
11.) Enter **Implement Width** in FT.

12.) **Tolerance -** start at 25%. You can lower this in the field. If the tolerance is too low, there will be unnecessary alarms. The Row Bar Graph will show red if a row is off-rate by the Tolerance % or more.

13.) Verify the number of rows in each section.

14b.) Press **More** to go to the next screen.

15.) See below: **Rate Mode** - For row monitoring set this to **AVG.** Sentinel will report how far from average each row is. For systems with less than 6 rows, set **User Def** and enter the rate.



23.) Press the **Back Arrow** when finished with this screen.

16.) **Smoothing** - Start with 10%. Typical setting will be from 5 to 15%.

The green line on the Row Bar Graph will not widen if the row variation is less than the Smoothing %.

17.) For Row Monitoring with Rate Mode set to AVG, you do not need to enter any rates.

18.) **Rate for Outside Rows** is typically “X 1.0”.

Some applications may be “X 0.5” (half-rate) or “X 1.5” (rate and a half) for outside rows.

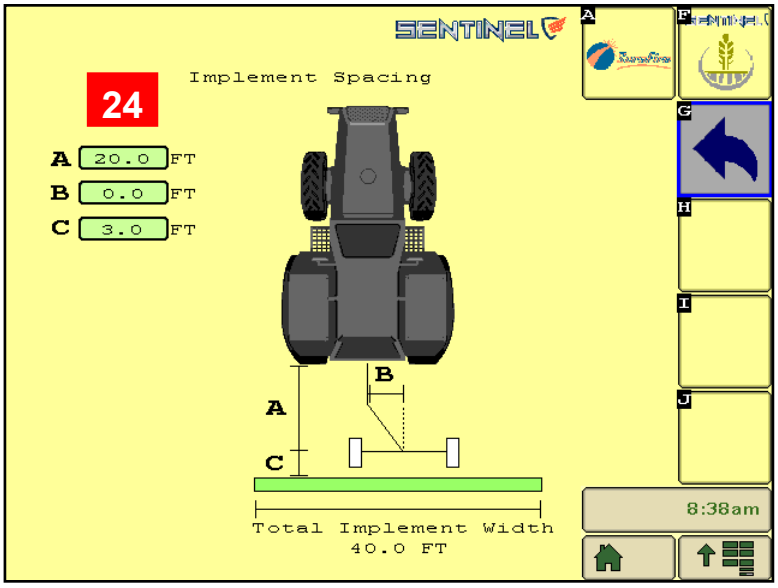
19.) **Split Row Mode** -

20.) **LiquiShift Enable** - Check this box if Sentinel is controlling LiquiShift on this product. (LiquiShift A-B valves can be controlled by a black LiquiShift Control Module on the back of the A-B Valve stack or can be plugged into and controlled by the Sentinel.)

21.) **LiquiShift A/B Close on Stop** - Typically this is not checked.

22.) **Module Orientation - ABCD** if Row 1 is A. **DCBA** if Row 1 is D on the Sentinel flowmeter module.

SETUP for Row Flow Monitoring - Implement - Speed - Hardware



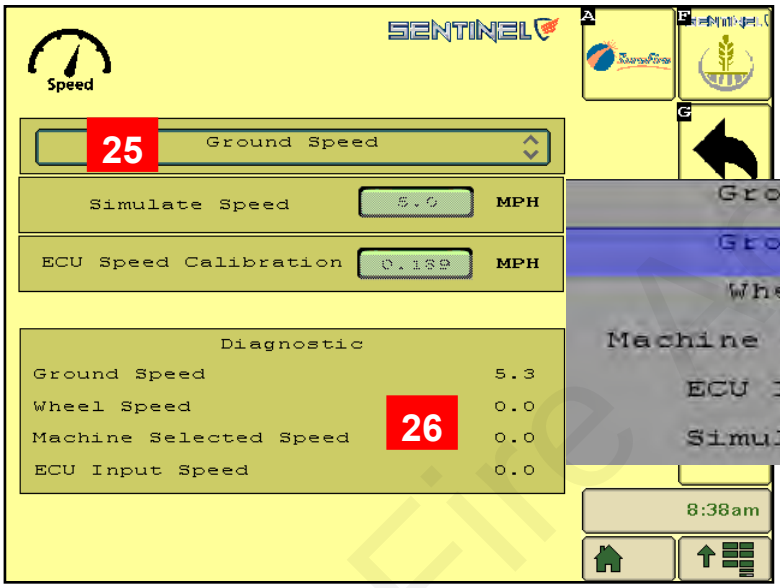
24.) Press **Implement** to enter and verify the Implement geometry.

The Implement dimensions are used when Task Control is enabled. This will not usually happen when Sentinel is only used for row monitoring.

24

A = distance from GPS Antenna to Hitch
B = implement offset
C = distance from hitch to application point

Press the Back Arrow when finished.



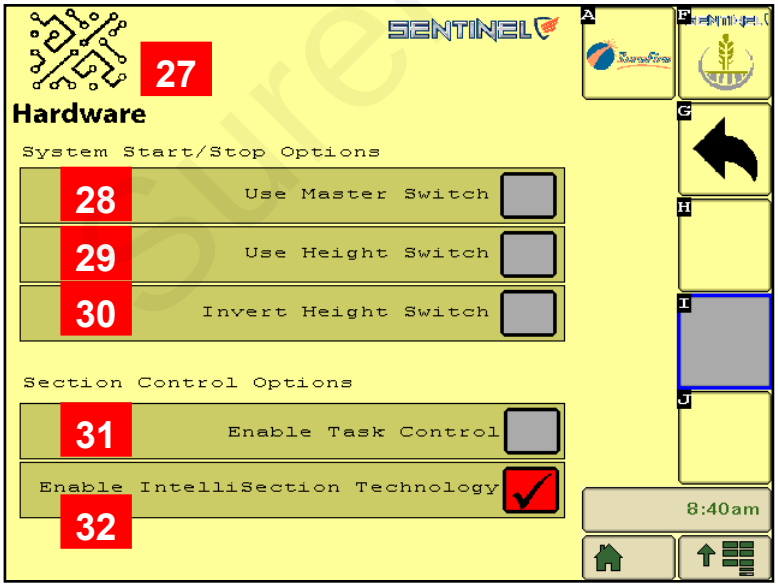
25.) On the right side, Press **Speed.**

Press the top box to select the Speed Source. This is typically Ground Speed.

25

26.) Check this box while moving to see which speed sources are reporting.

27.) On the right side, press **Hardware.**



28.) **Use Master Switch** - check this box if a dedicated Master Switch (Foot Switch) is plugged into Sentinel. This is usually not used for row monitoring systems.

29.) **Use Height Switch** - Check this only if the Sentinel has a dedicated height switch. This is usually not used for row monitoring.

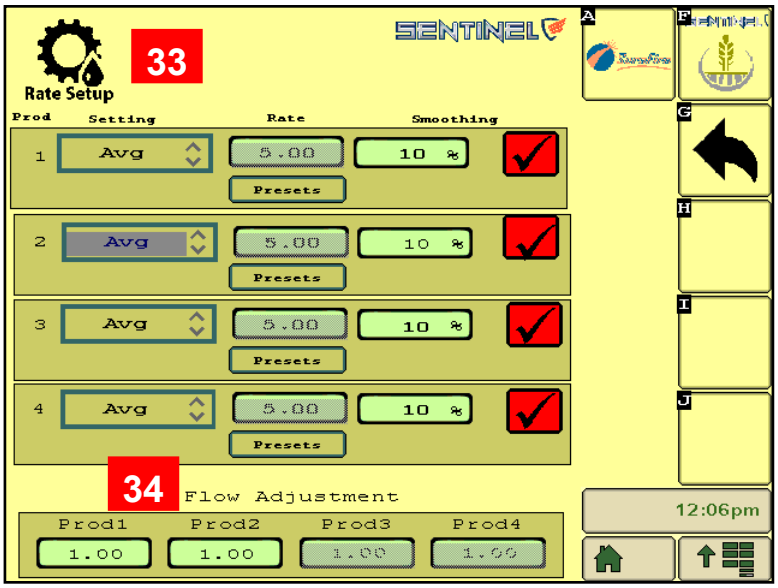
27

30.) **Invert Height Switch** if necessary for correct orientation.

31.) **Enable Task Control** - normally not used for row monitoring.

32.) **Enable Intellisection Technology** - used for row monitoring when Task Control is not used.

SETUP for Row Flow Monitoring - Rate Setup - Smoothing - Flow Adjustment

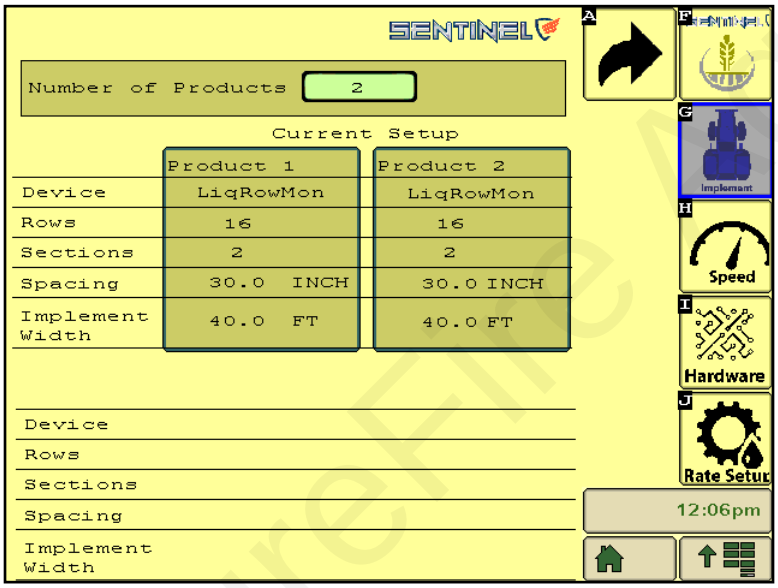


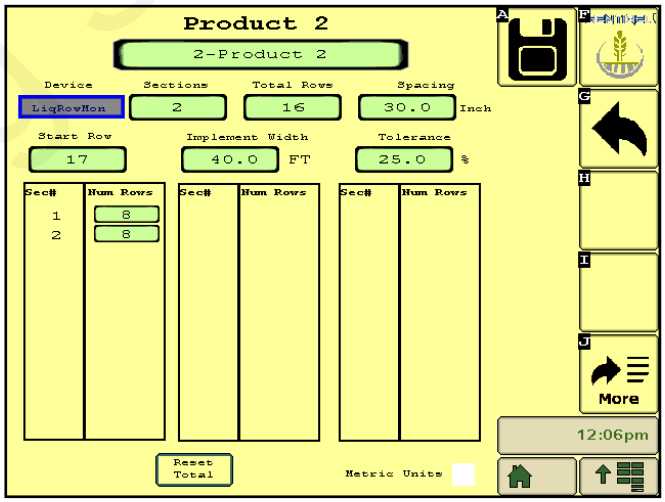
33.) For Row Monitoring verify the Setting is **AVG**. Smoothing usually starts at 10%. You do not need to enter a rate when it is set to AVG.

34.) **Flow Adjustment** - Use this to synchronize the Sentinel flowmeter modules with the main system flowmeter. Once the accuracy of the main flowmeter has been confirmed, change the Flow Adjustment factor as needed to synchronize the Sentinel reading with the main flowmeter reading.

$$\frac{\text{Main Flowmeter GPM}}{\text{Sentinel Total Flow GPM}} = \text{Flow Adjustment Factor}$$

SETUP for 2 products with Row Flow Monitoring

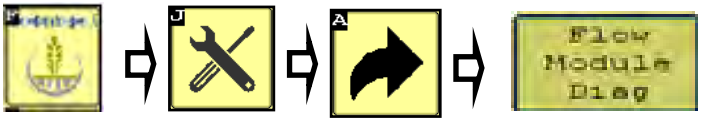




If you are setting up Sentinel to do row monitoring on 2 products your screen will look like this. You will need to go through the setup steps for both Product 1 and Product 2.

Sentinel Flow Module Setup and Configuration

Addressing Sentinel Flow Modules



Flow Module Diagnostics

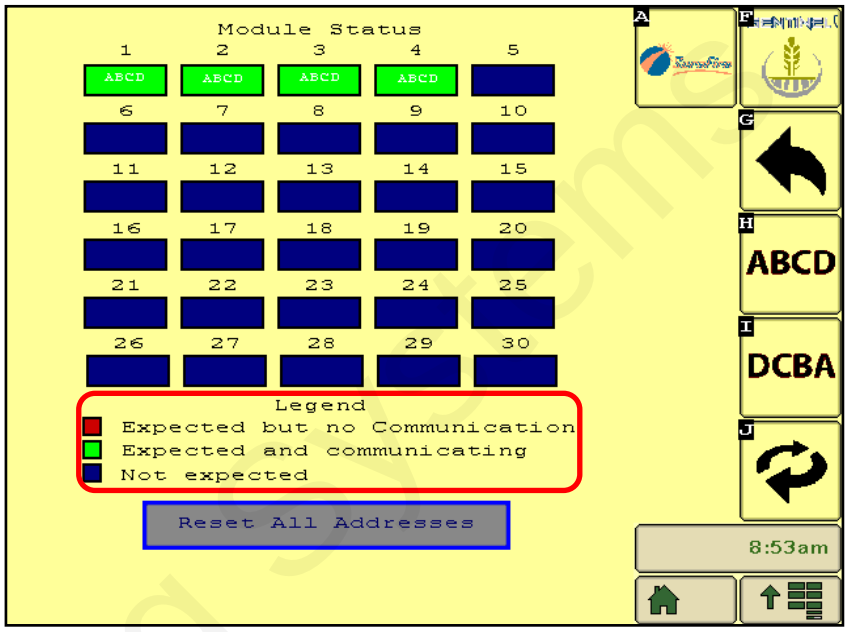
To address the Sentinel flow modules, start by having all the modules plugged in. From this screen, push **Reset All Addresses**. This sends a message to the modules to erase their address. All modules for Product 1 are then unplugged and then plugged back in, in order across the machine. As each module is plugged in, Sentinel identifies its location on the machine and the module is then given its new address and it will turn green on the screen. *Have someone watch this screen to be sure each module is recognized as it is plugged in.*

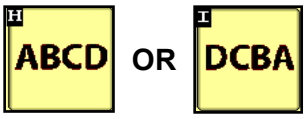
If there is a problem with modules not addressing, be sure the tractor is running to keep the voltage up.

Once all modules are addressed, choose the proper **orientation** as described below.

Repeat for each Product.

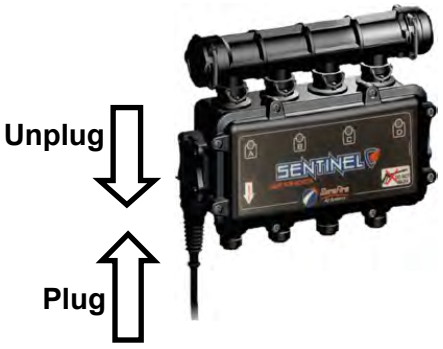
Flow Module Diagnostics Screen





Most machines will have the modules mounted facing forward, causing Row 1 to correspond with row D on the module. Therefore, the orientation DCBA must be selected. Likewise, if the modules are mounted rear-facing, the orientation ABCD will be selected.

Press the toggle button to go to the next page of modules if needed.



Example 16-Row—D C B A Orientation

Customizing Scans and Alarms for Row Monitoring

D
Setup & Operation

This screen allows the user to change how row information is displayed on the HOME screen.

35.) When checked, the **Auto Scan** feature will scan through the product pages and/or rows on the HOME screen. You can change the length of time it stays on each page or row before advancing.

36.) **Auto Hide Alarms (if checked)** sets how long full-page alarms are displayed before they go away.

37.) **Disable Alarms** - Check this to turn off alarms. May want to do this for testing or troubleshooting.

38.) **Alarm Time** - how long a row must be outside of the specified tolerance before the alarm sounds.

39. Re Alarm Interval - The time before the Alarm alarms again after being acknowledged. If the issue that triggered the alarm is not resolved, it will keep alarming at this interval until resolved (if the box is checked).

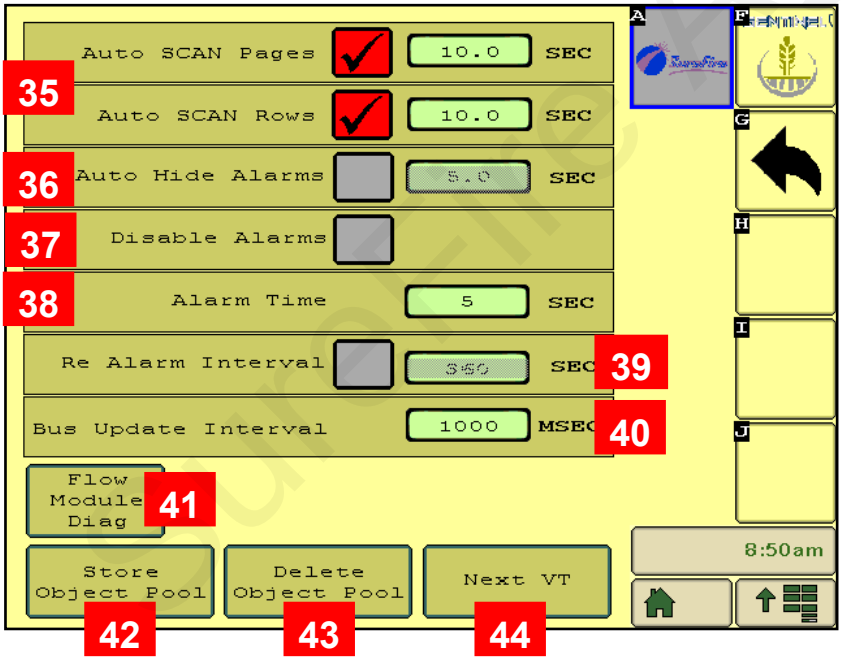
40. **Bus Update Interval -** Use this to slow down ISOBUS traffic if the BUS load is too high. *Reset only after talking to a SureFire representative.*

41.) **Flow Module Diagnostics** - Flow Module Diagnostics are addressed on previous page.

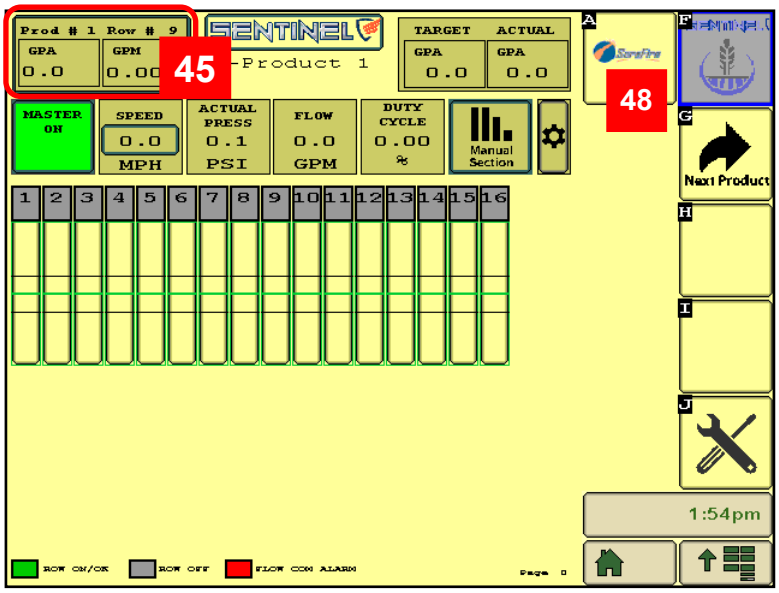
42.) **Store Object Pool** - Stores the current ISOBUS layout on the VT.

43.) **Delete Object Pool** - Deletes the current object pool on the VT and forces the monitor to regenerate the display when it is rebooted.

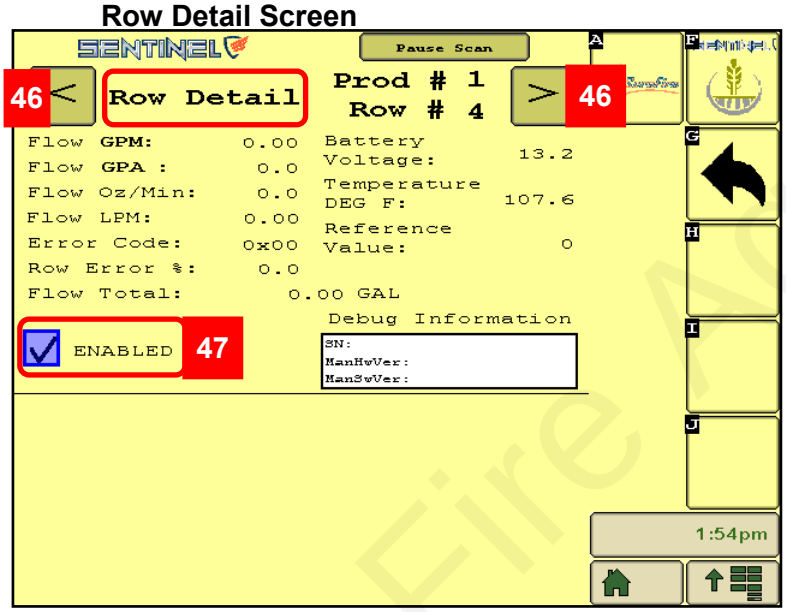
44.) **Next VT** - press to push Sentinel to another virtual terminal. This may be necessary if there is more than one monitor or display in the cab.

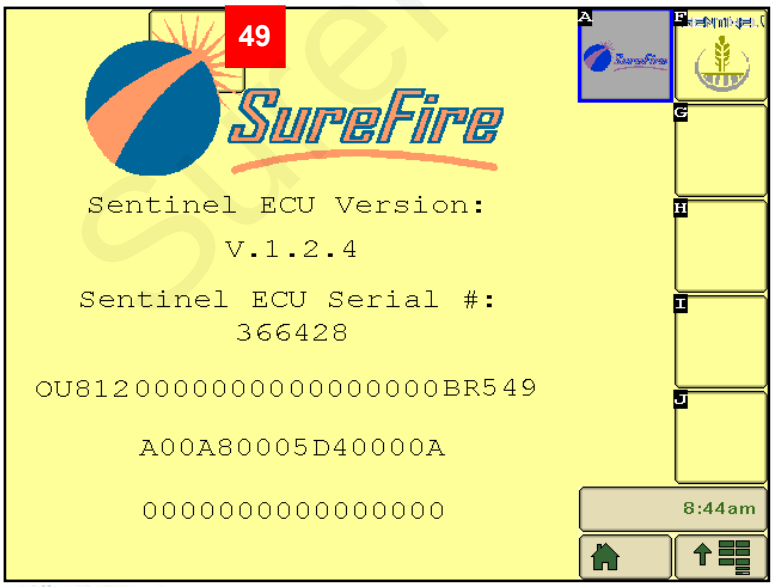


Row Detail Screen - Software Version - Auxiliary Settings



Row Detail Screen





45.) Pressing the Row Detail button (top left corner) on the Run screen brings up the Row Detail Screen.

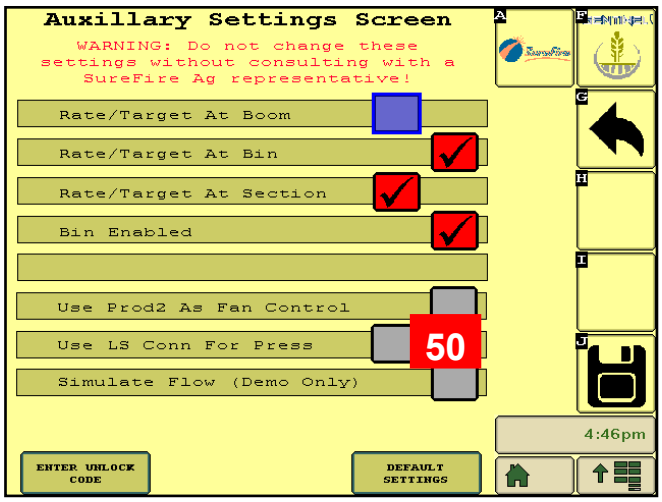
46.) Press the Left Arrow or Right Arrow to see details for other rows.

47.) A Row can be ENABLED or DISABLED by checking or unchecking the **ENABLED** box.

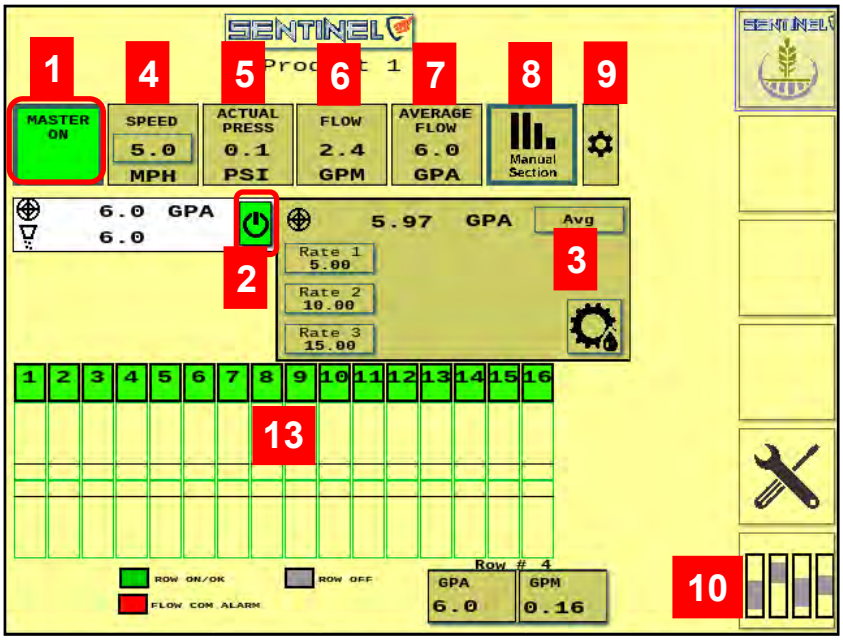
48.) Press the SureFire icon to see the software version number and Sentinel ECU number (see bottom left picture).

49.) **Auxiliary Settings Screen**- Press the sunburst. *Do Not Change anything unless directed by SureFire Tech Support.*

50.) **Use LS Conn for Press(ure) -** Check this box if using the Sentinel to control LiquiShift while using 3rd party rate control so pressure will display on rate control run screen.



Operating Sentinel Row Monitoring
TURN IT ON



For Sentinel Row Monitoring to work,

(1) MASTER ON button must be green, and (2) the Product ON/OFF button must be green.

(3) For Row Monitoring, Rate Mode is normally AVG.

(4) Sentinel will not operate until a SPEED is registered. Enter simulated speed here.

(5) The system pressure will not read here unless Sentinel is controlling LiquiShift, but will be shown on the Rate Controller screen.

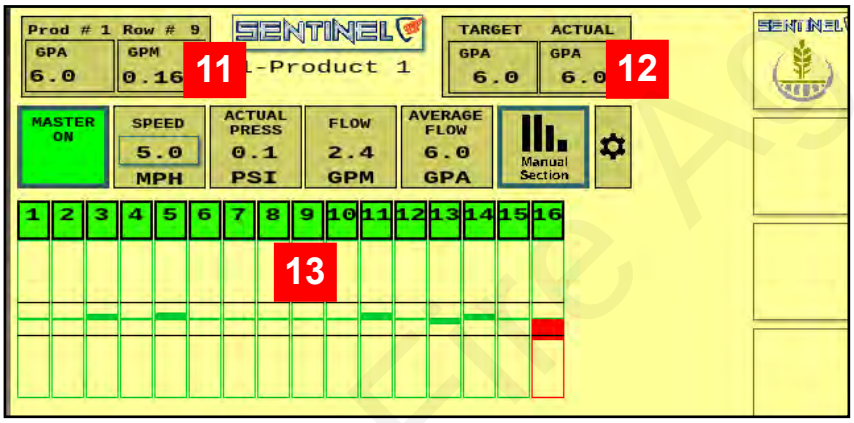
(6) Set up Total Flow / Min for this reading measured by the Sentinel flowmeter modules.

(7) Set up Avg Flow / Area for this reading measured by the Sentinel flowmeter modules.

(8) Manual Sections doesn't do anything for Row Monitoring. It works with Rate Control.

(9) Press this button to select which icons show up on this row of buttons. (see #14 below)

(10) Press this Row Bar View button to take out the middle section of the screen above, and show the screen below - the **Row Bar View** (normal Run Screen view for monitoring).

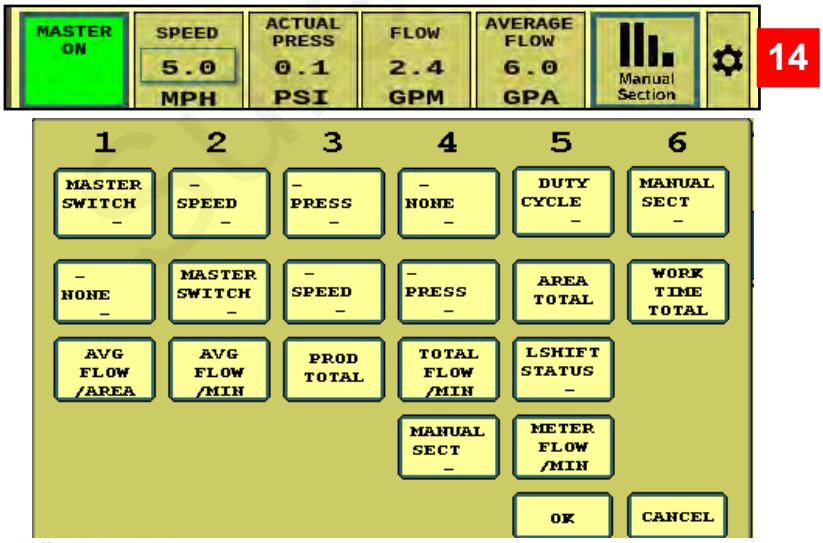


(11)**Row Detail button** scrolls through row by row to show the GPM and GPA measured by the Sentinel flowmeter on each row. Press on this box to see more row details.

(12)When doing only Row Monitoring with the Sentinel set to AVG Rate Mode, this box shows the average rate currently being applied on all rows as measured by the Sentinel flowmeter modules.

Row Detail Bar gives a bar graph view of the amount currently being applied by each row. The top screen shows a straight thin green line indicating that all the rows are applying with a variance less than the Rate (Row) Smoothing % that is set. A few rows on the bottom screen show a little wider green bar, indicating a variance that is greater than the Rate Smoothing %. The red bar on Row 16 indicates that this row is applying outside the Tolerance % set in the Product setup. The thin black lines above and below the green line show the Tolerance % that is set. Changing the Tolerance will move those black lines further apart or closer together.

Customizable Toolbar

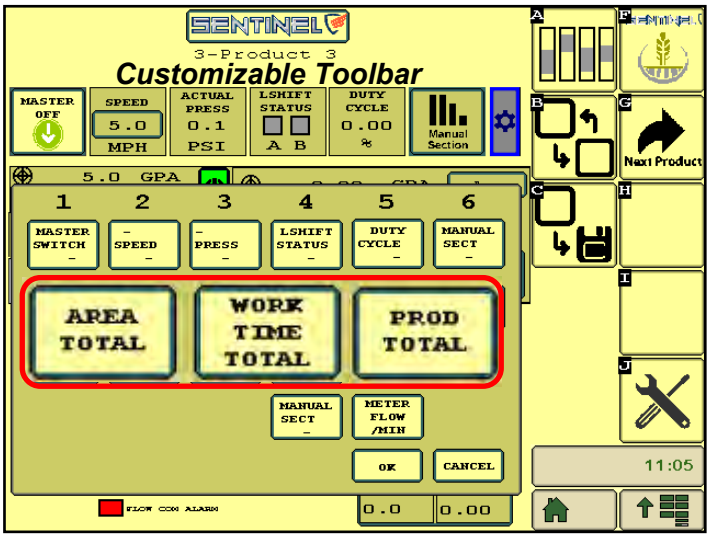


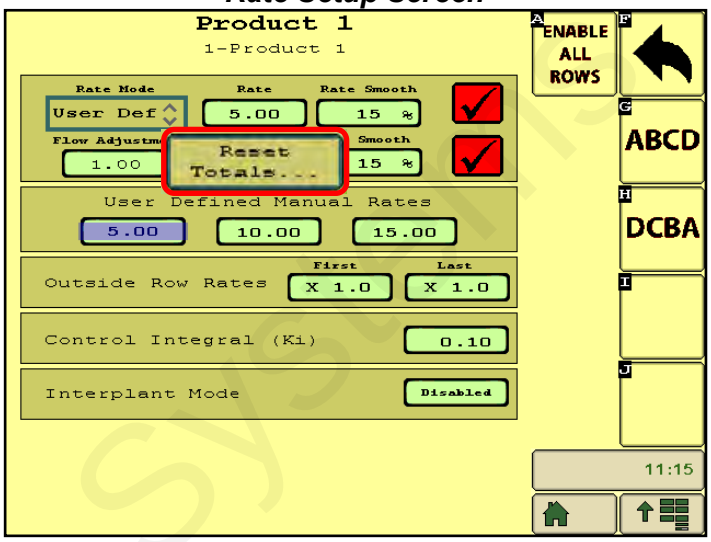
(14) **Customizable Toolbar -** Press on the gear to select which icons appear on this row. Example: Press on box 4 (None) - Select *Total Flow/Min* from below. Press OK- to have *Flow - GPM* display in box 4 of that toolbar.

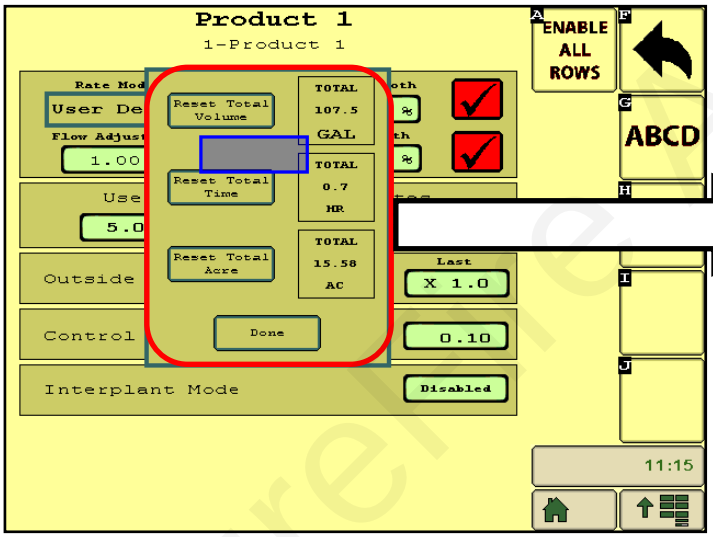
Customizable Toolbar & Totalizer Counters - Acres - Hours - Gallons

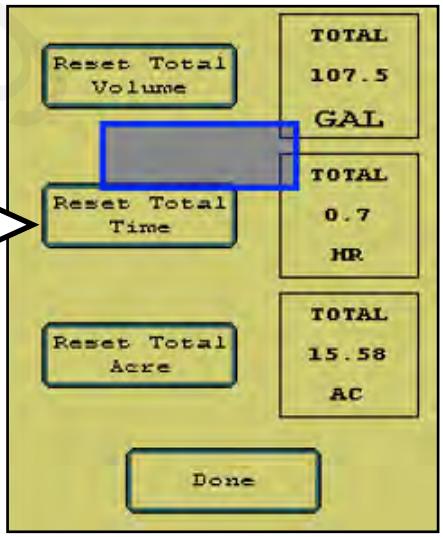
Sentinel has 3 totalizer counters to keep track of acres, hours, and gallons.
Any of these may be set up on the Customizable Toolbar near the top of the Product Run Screen. If these are not on the Customizable Toolbar, the values may still be seen by pressing the *Reset Totals* button on the Rate Setup screen. The items may be individually reset to 0 by pressing the Reset Total button for that item, or the totals may be left unchanged by returning to the Run Screen without resetting the values.

Rate Setup Screen









Sentinel Row Flow Monitoring Operation

D
Setup & Operation

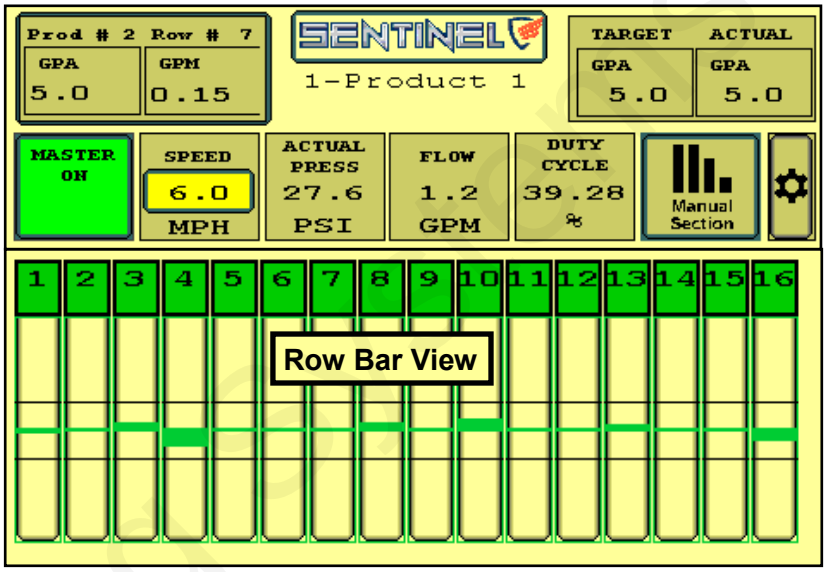
Once the Sentinel has been set up in the display, little is required of the user to operate the Sentinel. The system is designed to run in the background and only alert you if there is a problem. Most Sentinel users will spend a portion of their initial start-up time correcting inaccuracies in row-to-row flow on their implement. As previously mentioned, the HOME screen (Row Bar View) yields a quick snapshot of row-to-row comparisons while the row detail report gives more specific information about each row.

Row Bar Button

From the HOME screen, when the flow for a row or rows goes outside the set tolerance, the row will display red in the bar chart. When a row becomes plugged, the rest of the rows will show an increase in flow as product from the plugged row is now sent to the remaining rows. Likewise, if a row begins to show increased flow, such as in the case of a broken hose, the rest of the rows may show a decrease in flow.

Watching this screen for a while will allow you to see what the normal operating range is, so you can adjust the tolerance to avoid false alarms but to get timely notification if there is a problem.

Sentinel HOME Screen for Row Flow Monitoring



If a row-flow falls outside the set tolerance, a full page alarm is displayed with Product #, Row #, and low-flow (LF) or high-flow (HF). The length of time from when the row shows a problem to when this alarm is displayed is determined by the **ALARM TIME** previously set. This page will close automatically based on the **AUTO HIDE** time previously set.

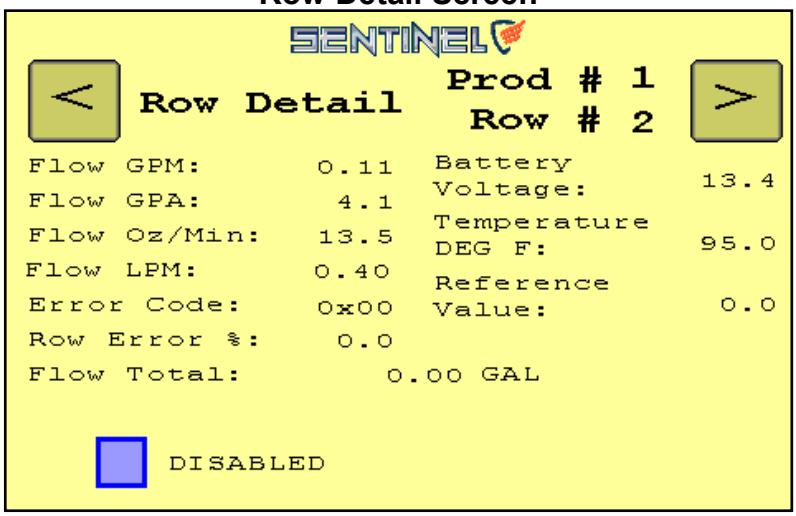
Alarm Screen

Row Detail Button

From the HOME screen, touching the row detail button will display the row detail page. The user can toggle through the rows by touching the **<** **>** buttons.

If there is an issue with the system, monitoring of individual rows may be disabled by checking the box.

Row Detail Screen



Setting Up

Sentinel Rate Control

Without Sentinel Flowmeters (No Row Monitoring)

226-01-3547Y1
Sentinel ISOBUS ECU

Typically will use one of the following Sentinel ECU Harnesses

For Rate Control **without Gen 3 LiquiShift**

208-06-5022Y1	Sentinel Row Control and Flow Monitoring ECU Harness- 2 products - 18 sections
208-06-4099Y4	Sentinel Row Control and Flow Monitoring ECU Harness - 2 products - 18 sections
208-06-4984Y2	Sentinel Row Control and Flow Monitoring ECU Harness - **4 products** - 18 sections

For Rate Control **with Gen 3 LiquiShift**

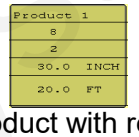
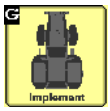
208-06-5023Y1	Sentinel Row Control and Flow Monitoring ECU Harness - **Gen 3 LiquiShift** - 2 PR - 16 sect
208-06-4701Y2	Sentinel Row Control and Flow Monitoring ECU Harness - **Gen 3 LiquiShift** - 2 PR - 16 sect
208-06-4985Y1	Sentinel Row Control and Flow Monitoring ECU Harness - **Gen 3 LiquiShift - 4 PR -** 16 sect

Sentinel Setup and Configuration
Set-up and Configuration for Rate Control

The following pages will guide you through the initial set-up and configuration of your Sentinel system for Rate Control. Below is an overview of the steps necessary to fully configure the system before operation. Each subsequent page outlines the page features as well as the sequence of buttons used to navigate to that page from the HOME screen.

Basic Steps for Initial System Set-up for Rate Control

For detailed information on a step, go to the referenced page

REFERENCE Page #	STEP
	1. Press the **HOME** button 
48	2. Go to the settings page by touching the **SETTINGS** button 
43	3. On the settings page, specify the number of products being monitored (maximum of 4)
48	4. Configure each product by touching the **PRODUCT** button 
48-49	5. Select **DEVICE - Liquid Rate Control** and set up each product with requested information for sections, rows, tolerance, etc…..
49	6. Select **MORE**, select **Rate Mode,** enter Rate and Smoothing (10%).
44	7. When finished, use the BACK arrow to go back to the SETTINGS  menu.
50	8. Set up the implement dimensions by touching the **IMPLEMENT** button. 
50	9. Choose a speed source by selecting the **SPEED** button. 
50	10. Select system control options (task control, lift switch, etc.) under **HARDWARE.**
51	11. **RATE SETUP -** Select the Rate Mode **Rx** or **User Def** and enter Rates. 
52	12. RATE CONTROL SETUP (Control Speed, Flow Cal, PWM Settings, etc..)and OPERATION information
53	**13. Nozzle Test (v 1.3.0)**
54-55	**14. Catch Test (v 1.3.0)**
56	**15.** Customizable Toolbar and Totalizer Counters
57-58	**16.** Rate Control Operation and Setup Summary

Sentinel Setup and Configuration

Home Screen Navigation for Rate Control

Sentinel Home Screen for Rate Control.

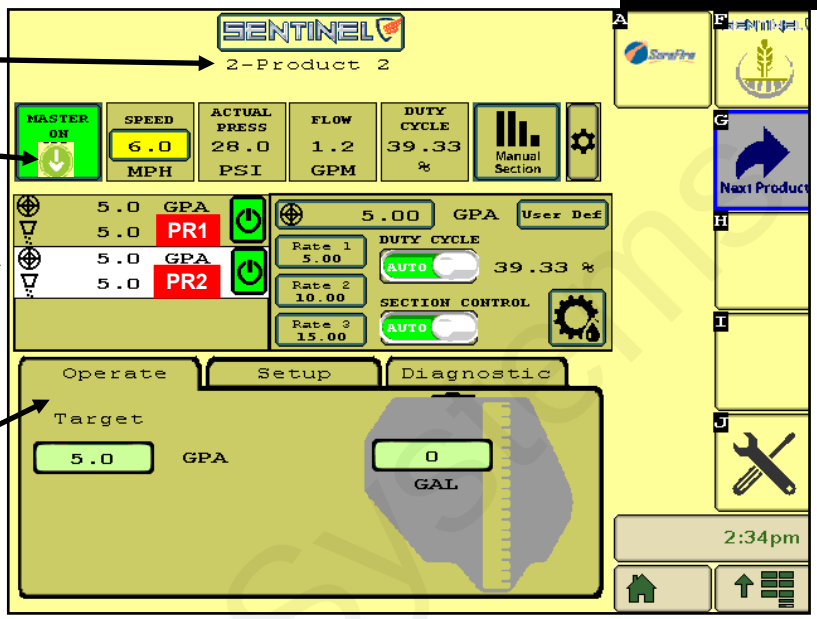
Identifies this screen as showing Product 2.

If an implement height switch is plugged into the Sentinel harnessing, there is an arrow showing the current implement height status.

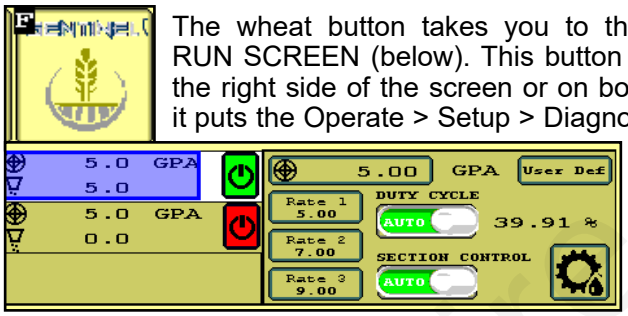
Target and Actual Rate shown. Green buttons indicate product is ON.

Operate, Setup, & Diagnostic tabs for Rate Control setup, operation, and troubleshooting diagnostics.

Sentinel HOME Screen



BUTTONS: Wheat & Row Bar



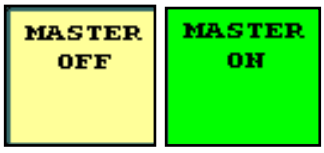
The wheat button takes you to the Multi-Product RUN SCREEN (below). This button may appear on the right side of the screen or on bottom left, where it puts the Operate > Setup > Diagnostic view on the bottom half of the screen (see above).

The SENTINEL ROW BAR button appears when using row flow monitoring. When doing row flow monitoring, this takes you to the row bar view page. This button may appear on the right side of the screen or on bottom left, where it puts the Row Bar View on the bottom half of the screen.

Touching this gear button will allow you to set up the icons on this **Customizable Toolbar** row of the screen. When you press this button you will see three rows of icons. The top row shows what is on your screen now. To change an icon, press on that icon on the top row and then press on the icon you want there on the 2nd or 3rd row. Click OK.

Toggle between product screens by touching the **NEXT PRODUCT** button.

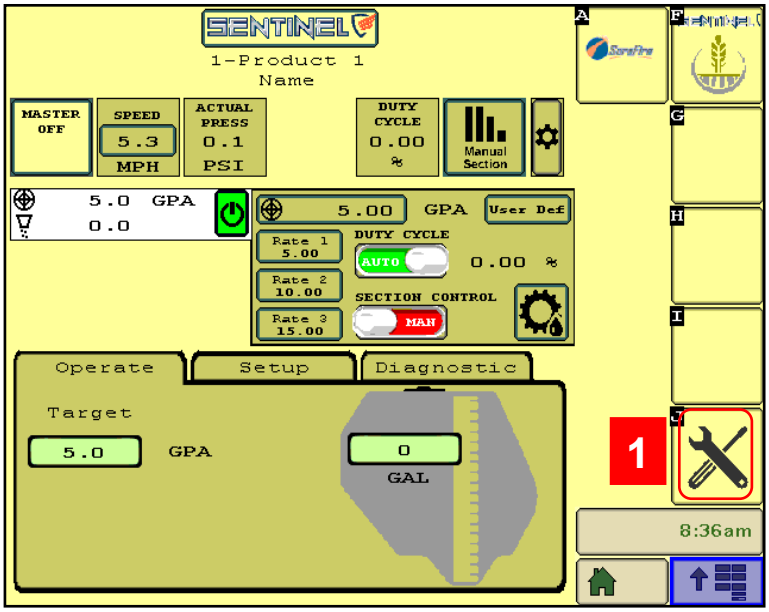
The **SETTINGS TOOLS** button will be used to access the system configuration pages for Product setup and to change individual product alarm, tolerance, and rate settings.



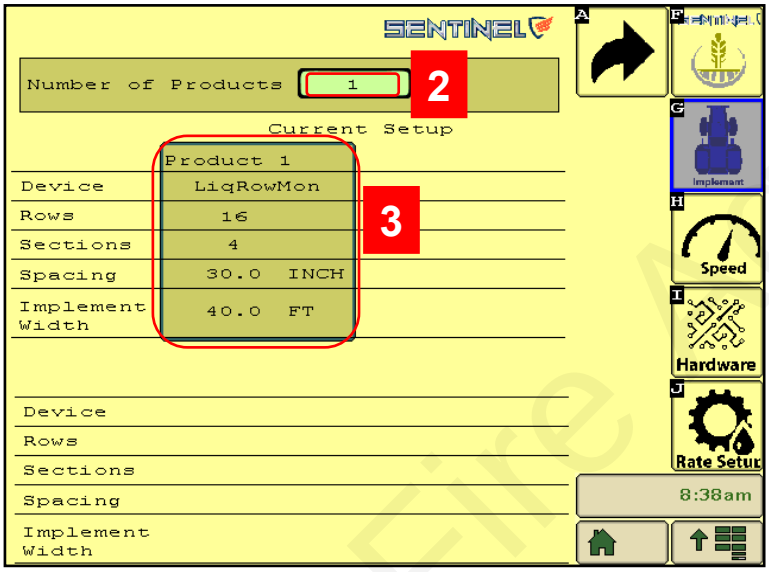
The **MASTER ON/OFF** button enables and disables the Sentinel system. *This must be **GREEN (MASTER ON)** for Sentinel to work.*

ARROW indicates implement position when using Implement Switch with Sentinel

SETUP for Rate Control - Settings - Product Setup - Device Type



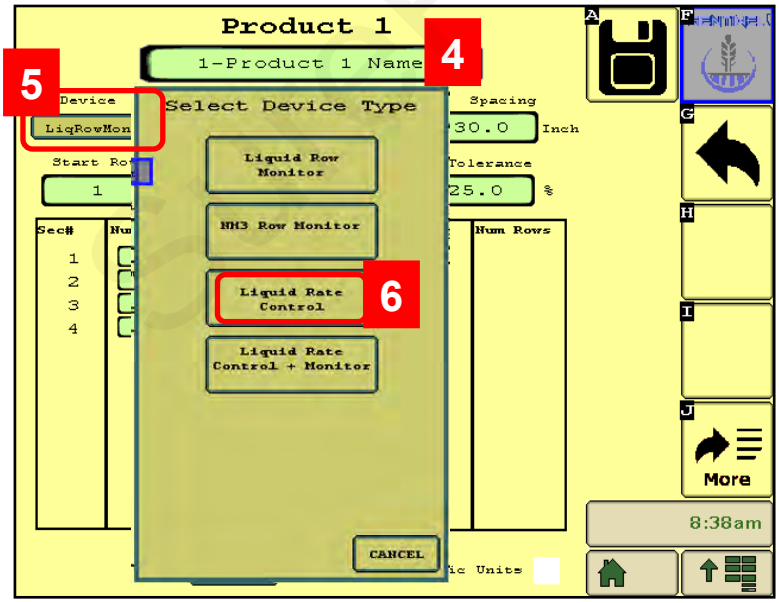
1.) Press the **SETTINGS** Tools button to go to the System Configuration screens.



2.) Enter the **number of products** that will be monitored or controlled with the Sentinel.

3.) Press the big **Product 1** box.

(If the system has two products, there will be a Product 2 box to the right of Product 1. Set up Product 2 in a similar fashion to what is shown for Product 1.)

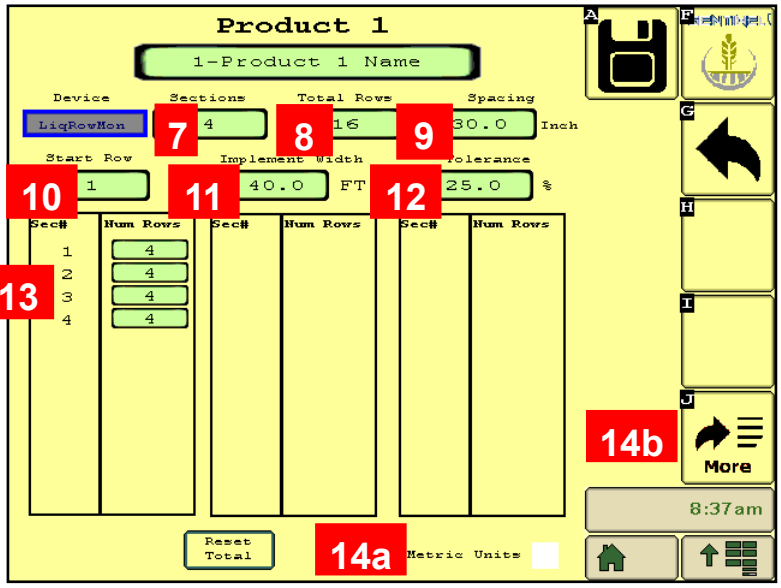


4.) Enter a name for the Product.

5.) Press the box under "**Device**".

6.) Select "**Liquid Rate Control**" to use the Sentinel ECU to control the liquid application system.

SETUP for Rate Control - Product Setup - Rate Mode Setup - LiquiShift Enable



7.) Enter the number of **SECTIONS** for this product.

8.) Enter the number of **ROWS** for this product.

9.) Enter the row spacing in **INCHES**.

10.) **Start Row** = 1 for Product 1.

Product 2 Start Row will typically be 1 more than the number of Rows on Product 1. On a 16-row system, Product 2 will start with Row 17.

11.) Enter **Implement Width** in FT.

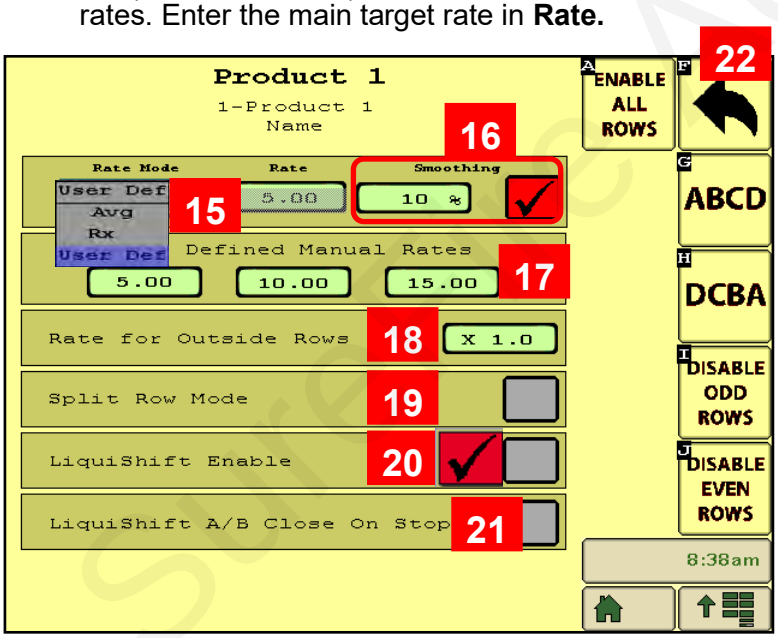
12.) **Tolerance** - start at 25%. This only applies to Row Monitoring.

13.) Verify the number of rows in each section.

14a). Check this box for **Metric Units.**

14b.) Press **More** to go to the next screen.

15.) See below: **Rate Mode** - For rate control, set this to **Rx** (for prescriptions) or to **User Def** to enter preset rates. Enter the main target rate in **Rate.**



16.) **Smoothing** - Start with 10%. If the actual rate at any time is within this % of the Target Rate, the display will show the Actual Rate as being equal to the Target Rate.

17.) You can enter up to 3 user-defined rates. These can also be entered on the Rate Setup screen.

18.) **Rate for Outside Rows** is typically “X 1.0”.

Some applications may be “X 0.5” (half-rate) or “X 1.5” (rate and a half) for outside rows.

19.) **Split Row Mode** -

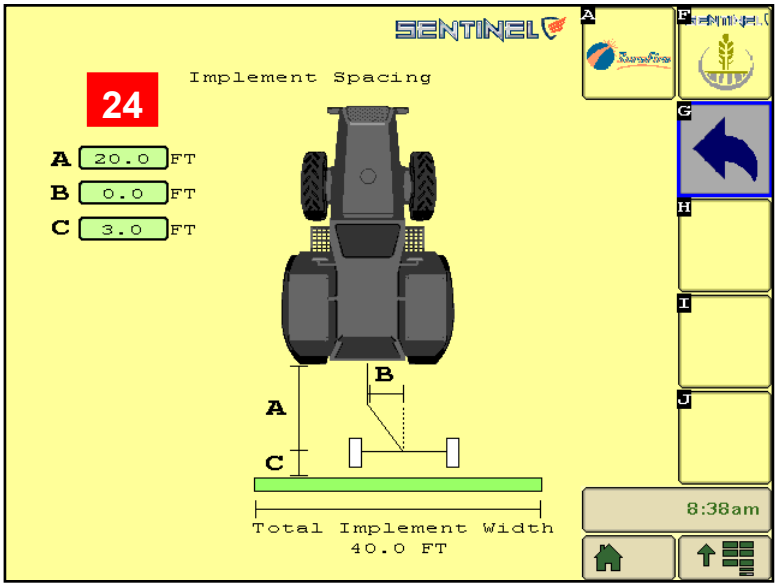
20.) **LiquiShift Enable** - Check this box if Sentinel is controlling LiquiShift on this product. (LiquiShift A-B valves can be controlled by a black LiquiShift Control Module on the back of the A-B Valve stack or can be plugged into and controlled by the Sentinel.)

21.) **LiquiShift A/B Close on Stop** - Typically this is not checked.

22.) Press the **Back Arrow** when finished with this screen.

Rate Setup screen from v 1.3.0.

SETUP for Rate Control and Row Flow Monitoring - Implement - Speed - Hardware

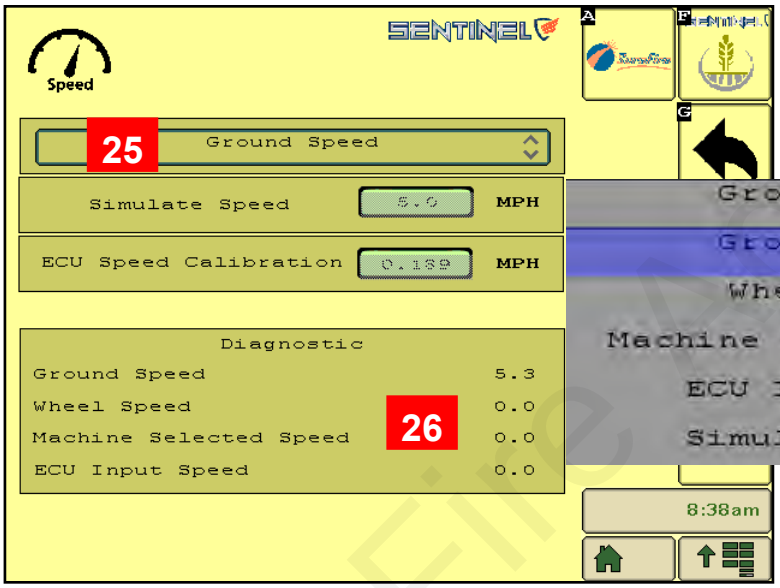


24.) Press **Implement** to enter and verify the Implement geometry.

The Implement dimensions are used when Task Control is enabled. Task Control is normally enabled for Rate Control. Task Control is needed for Section Control and Mapping.

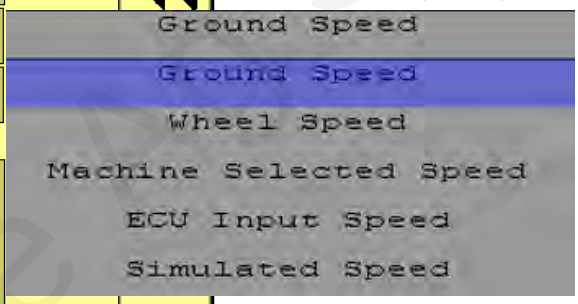
A = distance from GPS Antenna to Hitch
B = implement offset
C = distance from hitch to application point

Press the Back Arrow when finished.



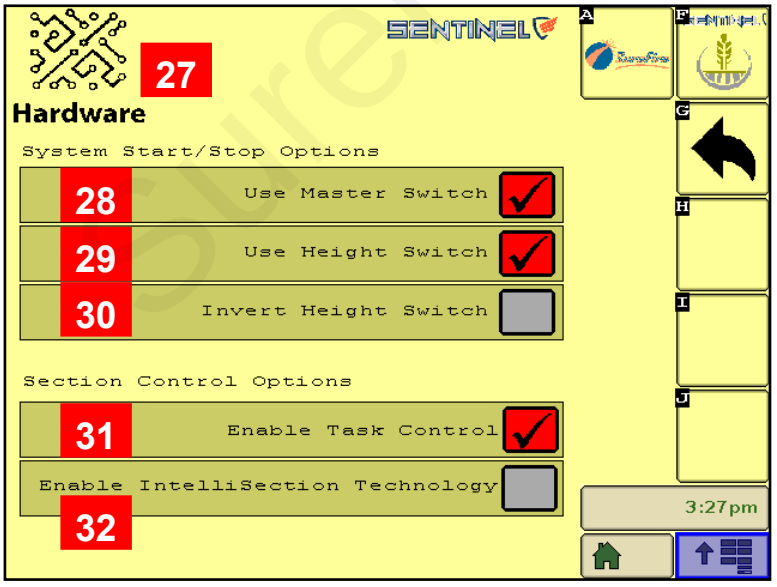
25.) On the right side, Press **Speed.**

Press the top box to select the Speed Source. This is typically Ground Speed.



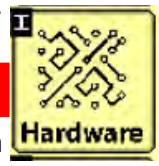
26.) Look at this box while moving to see which speed sources are reporting.

27.) On the right side, press **Hardware.**



28.) **Use Master Switch** - check this box if a dedicated Master Switch (Foot Switch) is plugged into Sentinel. Quite often used for Rate Control.

29.) **Use Height Switch** - Check this only if the Sentinel has a dedicated height switch. Quite often used for Rate Control.

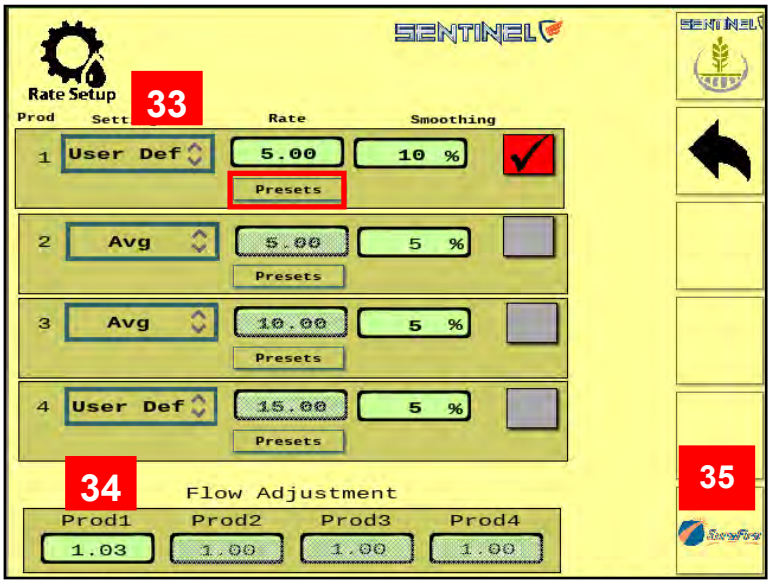


30.) **Invert Height Switch** if necessary for correct orientation.

31.) **Enable Task Control** - normally used for Rate Control. Also, activate Task Control on display.

32.) **Enable Intellisection Technology** - not usually used for Rate Control when Task Control is used.

SETUP for Rate Control - Rate Setup - 2 Products - Version Number - Auxiliary Settings

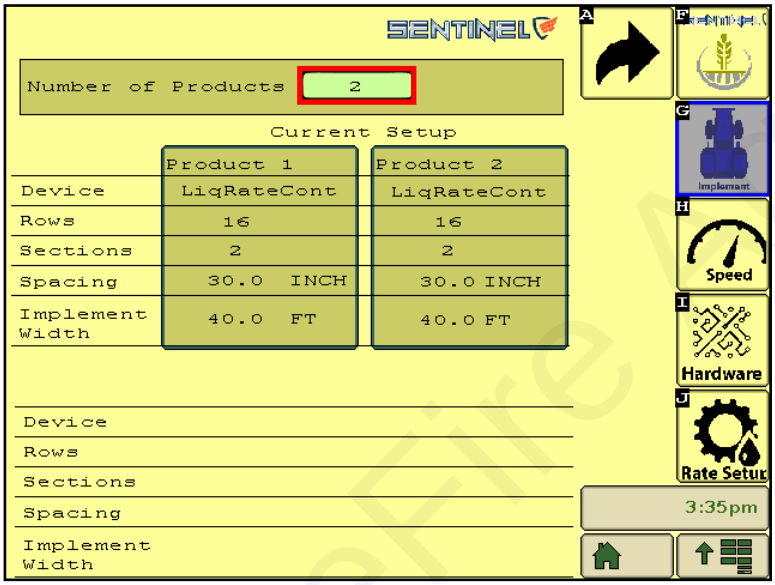


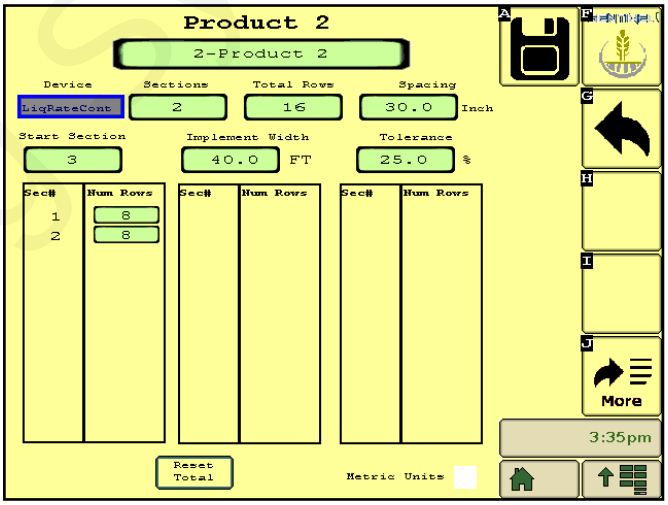
33.) For Rate Control, the Setting should be **Rx** or **User Def.** Smoothing usually starts at 10%. You can enter a Target Rate here. Press **Presets** to enter up to 3 User-Defined rates.

34.) **Flow Adjustment** - Only used with Sentinel flowmeter modules.

35.) Press the SureFire icon to see the Sentinel ECU version information (see below).

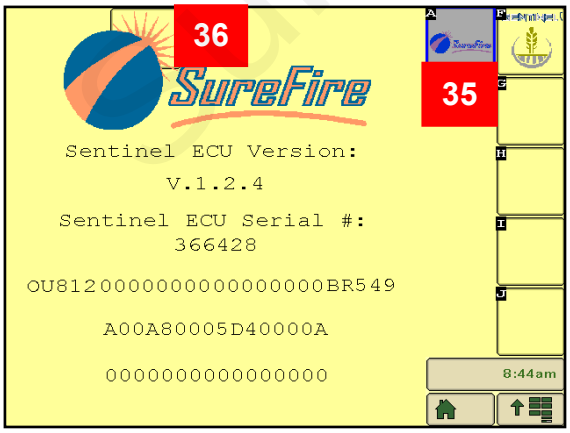
SETUP for 2 products with Rate Control





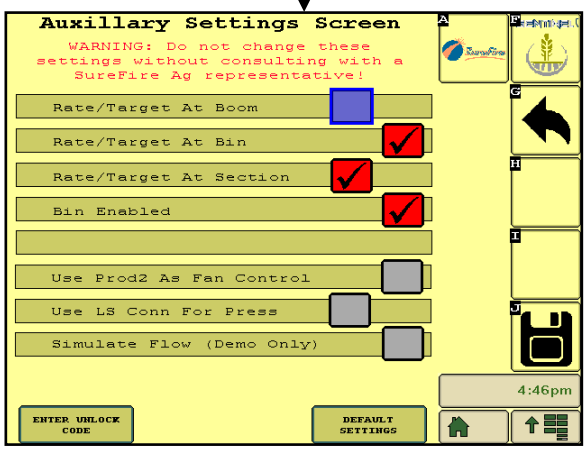
If you are setting up Sentinel to do Rate Control on 2 products your screen will look like this (above). You will need to go through the setup steps for both Product 1 and Product 2.

Auxiliary Settings Screen

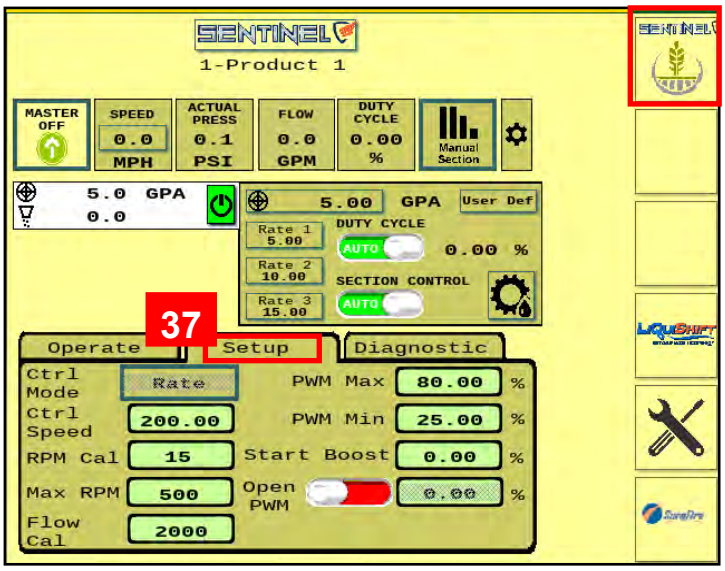


35.) Press the SureFire icon to see the Sentinel ECU version information.

36.) Press the square by the sunburst to see the Auxiliary Settings Screen. *DO NOT CHANGE* these unless directed by SureFire Support.



SETUP for Rate Control - SETUP - Control Speed - Flow Cal - PWM Max and Min



37. From the Sentinel HOME screen, press the center **SETUP** tab.

Start with the following settings. Adjust as needed.

Ctrl Mode - RATE

Ctrl Speed - PR17 - 250-300 PR30 - 200
PR40 - 160 D250 - 150
Tower Electric - 2000

Adjust as needed in the field. Increase the Ctrl Speed if the pump is slow to adjust. Decrease the Ctrl Speed if the pump fluctuates and will not lock on to the rate going across the field.

RPM Cal - 15 (for hydraulic pumps equipped with RPM sensor)

Max RPM - 500 (Can be set to 550 if needed)

Flow Cal - 2000 - most hydraulic pump systems
0.6 to 13 gpm flowmeter and larger.
3000 - most electric pump systems
0.3 to 5 gpm and smaller

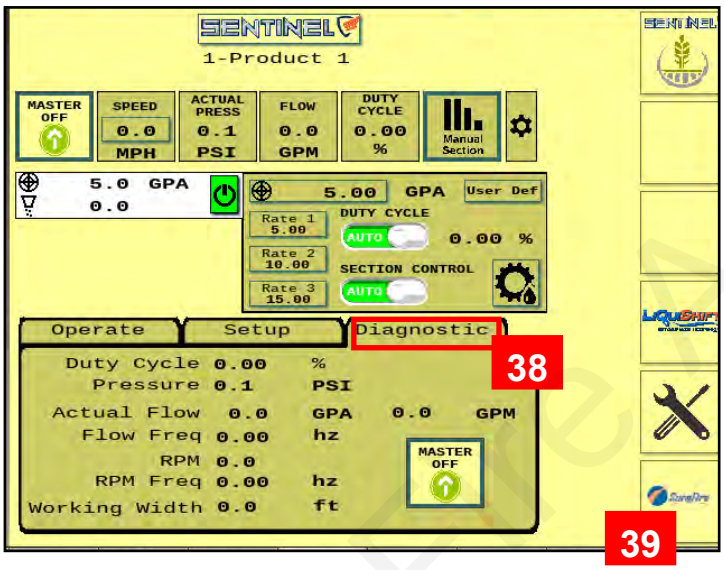
(Flow cal number is on serial number sticker on side of flowmeter)

PWM Max - 80 to 100

PWM Min - 25 for most hydraulic pumps.
5-10 for most electric pumps.

Start Boost - usually 0. Can be set slightly higher than normal PWM Duty Cycle for a startup boost.

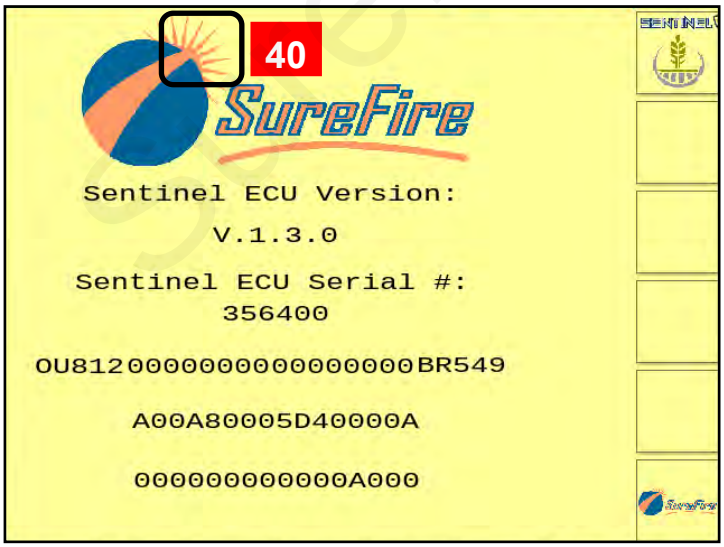
Open PWM - Normally RED. Turn to GREEN if you want the pump to continue running for product agitation while you turn around. When doing that, enter a PWM % to set the pump speed for agitation (usually 30-40%)

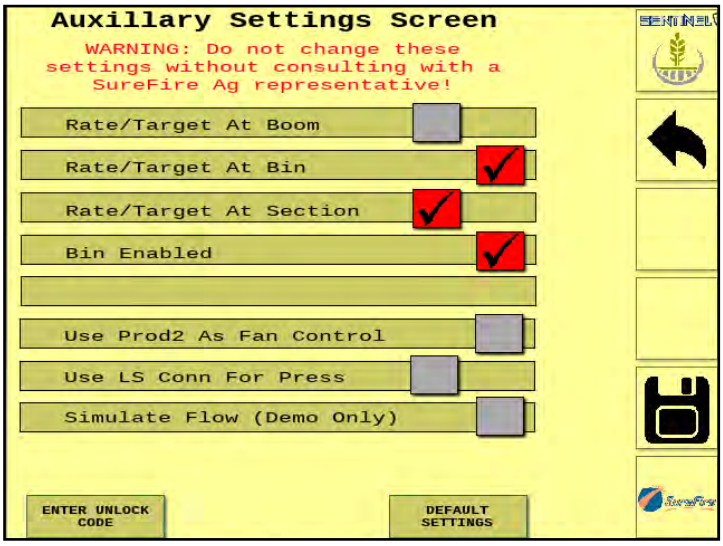


38. **DIAGNOSTIC TAB** - Observe the system parameters during operation.

39. Press SureFIre to see software version information.

40. Press Sunburst for Auxiliary Settings.

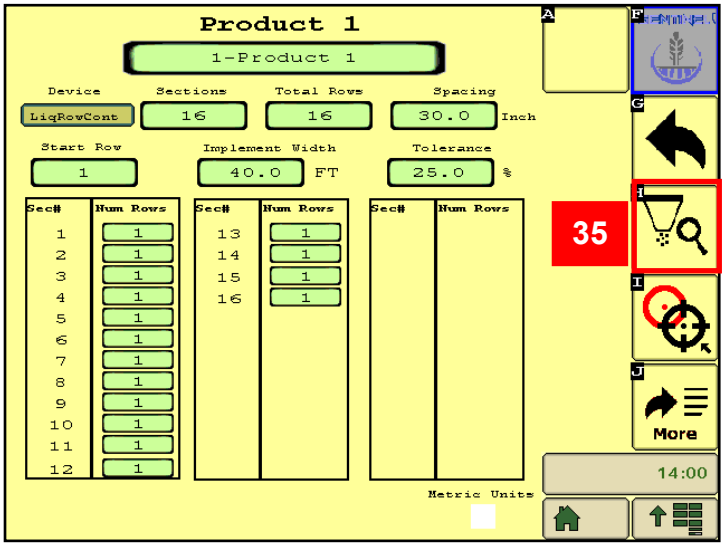




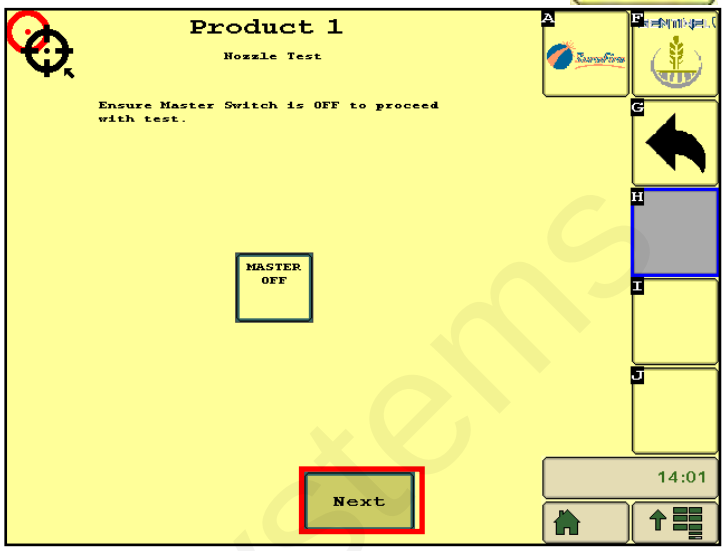
SETUP for Rate Control - TESTS - Nozzle Test (v 1.3.0 and later)

Test run the system with a simulated speed and target rate.

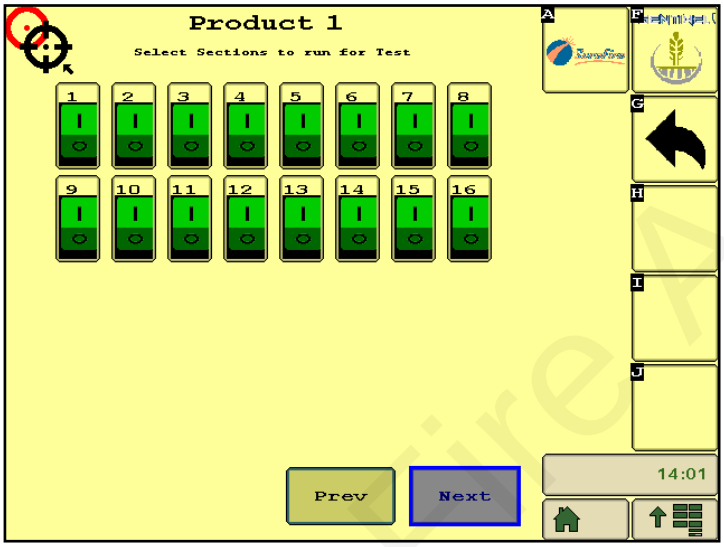
From the Product Setup page press the Nozzle Test icon.



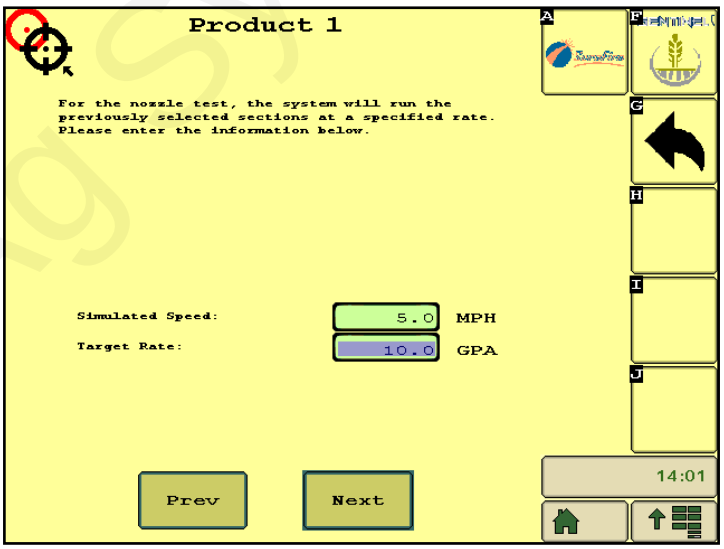
Be sure MASTER is OFF. Press NEXT.



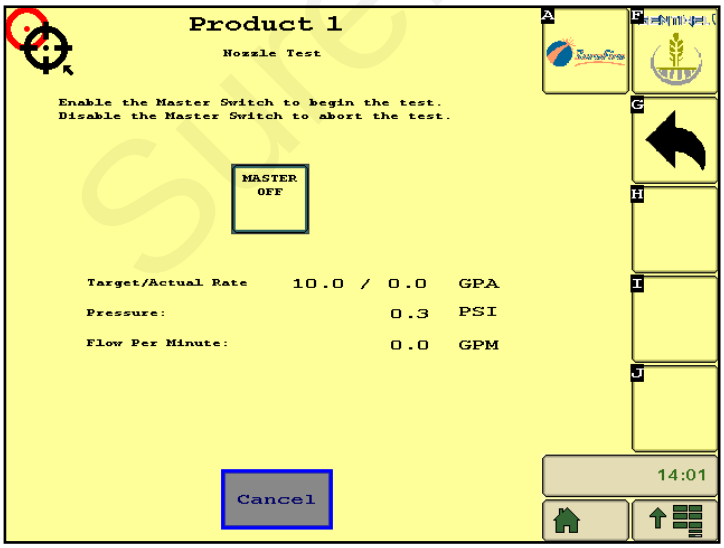
Select which sections you want to run for this test. NEXT.



Enter SPEED and RATE. NEXT.



Turn MASTER ON to start the test. Monitor Actual Rate, Pressure, and Flow per Minute.



To stop the test, turn MASTER OFF.

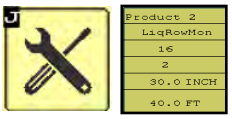
If only 1 or 2 rows are on, the system may struggle to maintain a smooth output and rate.

When testing with water, the pressure will be much less than it will be with a heavier, thicker fertilizer. On a system with check valves, some of the check valves may not open at low pressure.

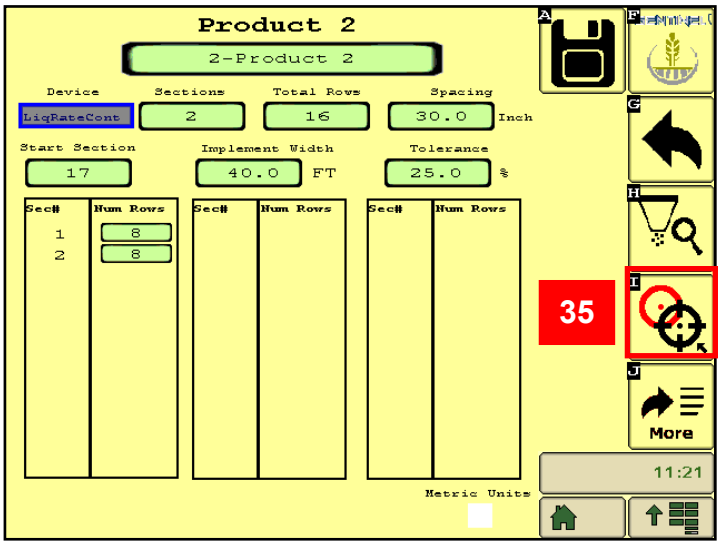
Increase the speed or rate to increase the pressure.

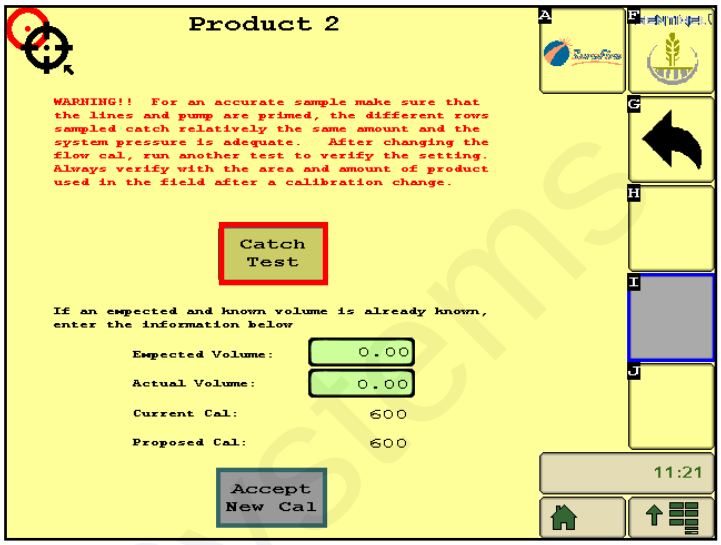
SETUP for Rate Control - TESTS - Catch Test (v 1.3.0 and later)

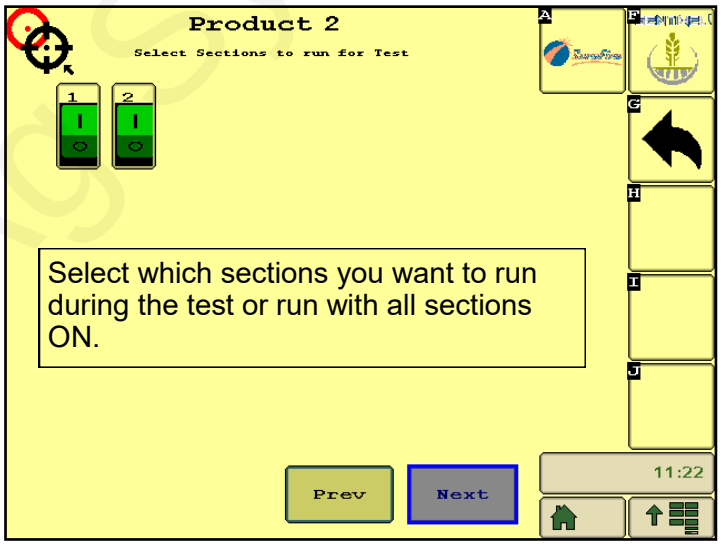
Verify and adjust the flowmeter calibration.

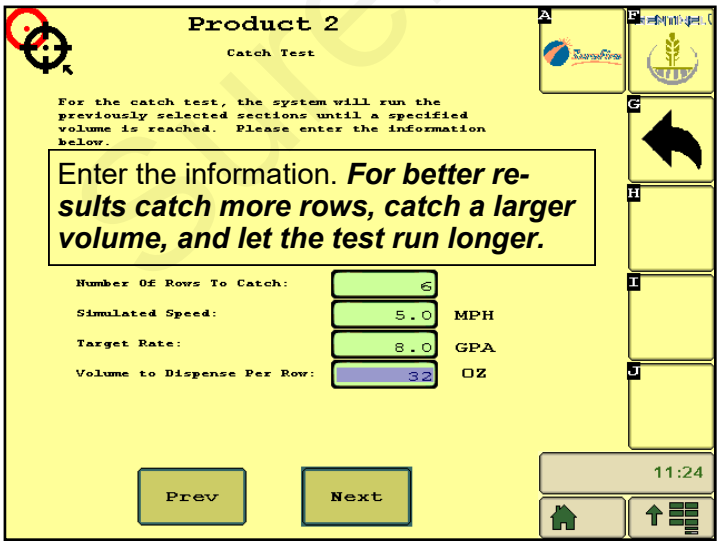


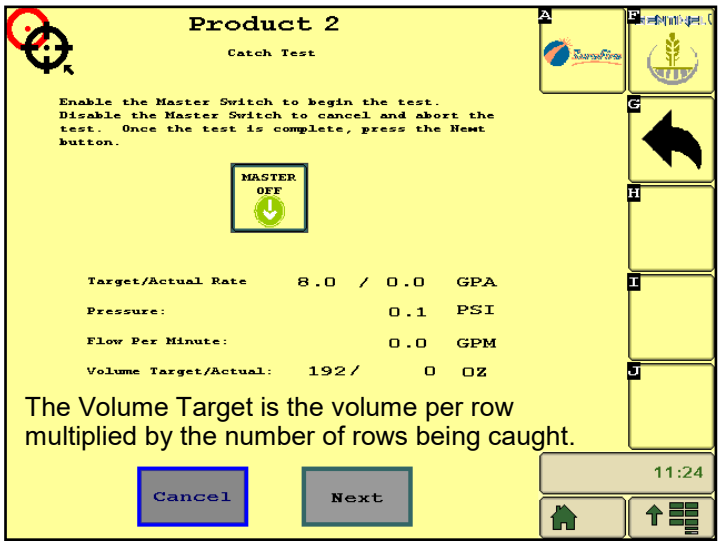
From the Product Setup page press the Catch Test icon (35). Be sure MASTER is OFF. Press CATCH TEST.











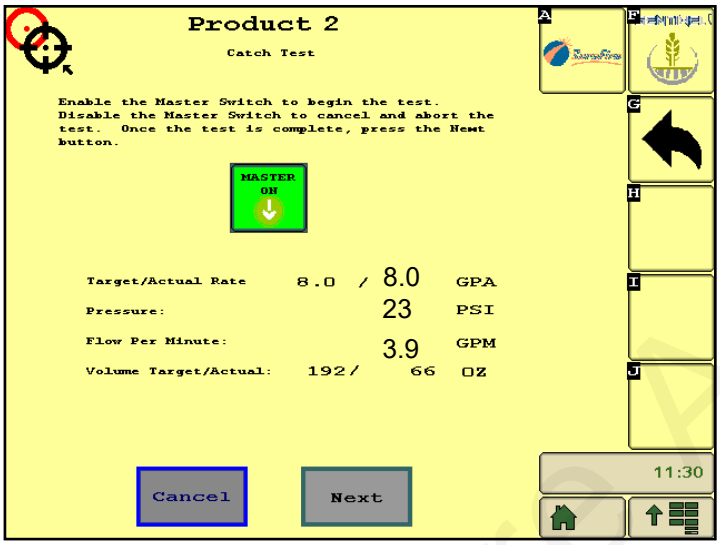
SETUP for Rate Control - TESTS - Catch Test (v 1.3.0 and later)
Verify and adjust the flowmeter calibration.

While the test is running, the actual rate, pressure, and GPM will be shown. The Volume Target is the volume per row multiplied by the number of rows being caught. When the Volume Target for the test rows is reached, the test will stop. Pour together or add together the amount caught in all the rows tested. Enter this amount in **Actual Volume (1)**.

Repeat the catch test to verify consistency and accuracy. Note: catch tests with water, especially if the system is operating at a low pressure, may not give an accurate catch test.

SureFire electromagnetic flowmeters are typically very accurate out of the box with the factory flow cal. With accurate tests and measurements it is possible to calibrate them to 1 to 2% accuracy. A short test on a few rows with a small sample caught may not be accurate enough to adjust the flow cal. Always verify the flow cal in the field by comparing acres worked and gallons applied.

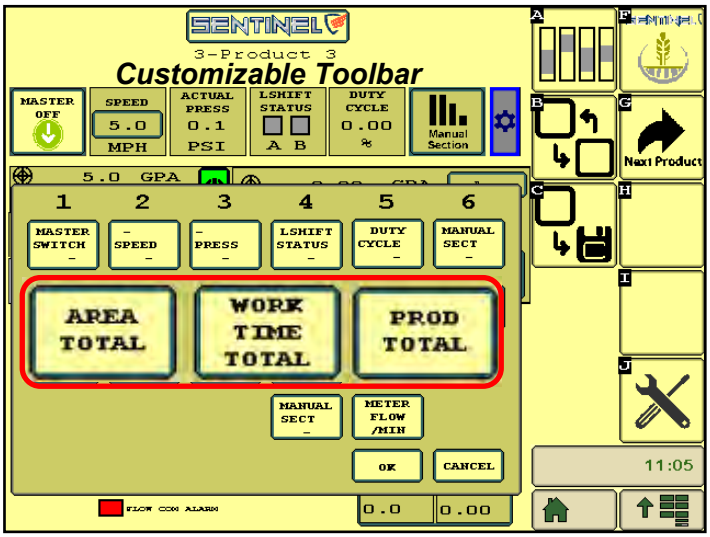
Best practices dictate ongoing verification of acres worked and gallons applied to verify flow cal.

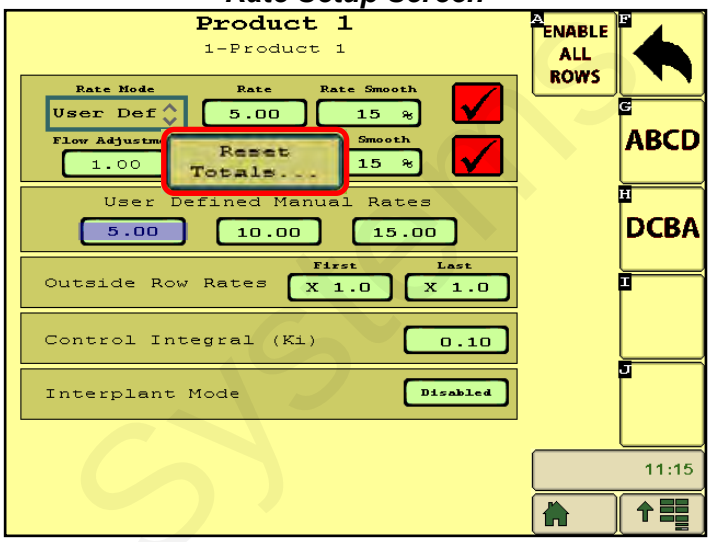


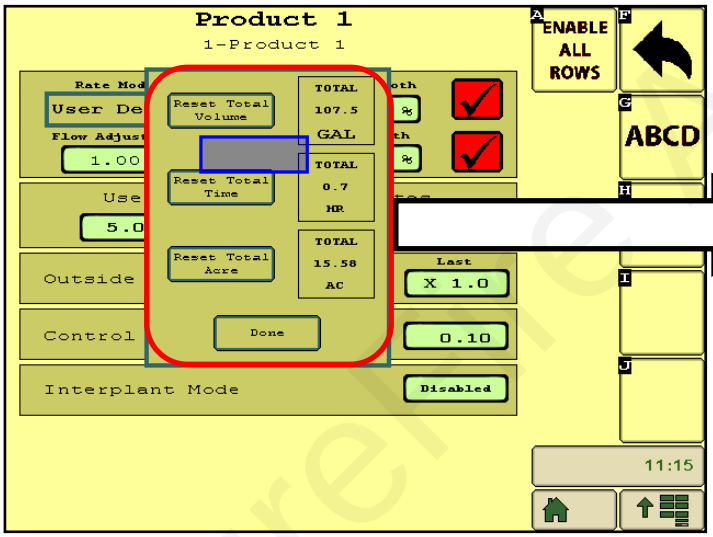
Customizable Toolbar & Totalizer Counters - Acres - Hours - Gallons

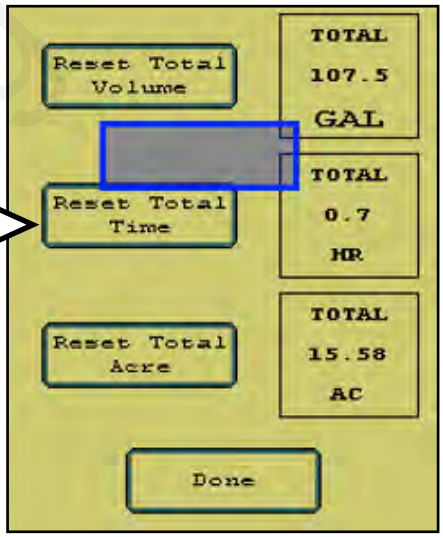
Sentinel has 3 totalizer counters to keep track of acres, hours, and gallons.
Any of these may be set up on the Customizable Toolbar near the top of the Product Run Screen. If these are not on the Customizable Toolbar, the values may still be seen by pressing the *Reset Totals* button on the Rate Setup screen. The items may be individually reset to 0 by pressing the Reset Total button for that item, or the totals may be left unchanged by returning to the Run Screen without resetting the values.

Rate Setup Screen









Sentinel Rate Control Operation

D
Setup & Operation

Once the Sentinel has been set up in the display, little is required of the user to operate the Sentinel. The system can be started with an Implement Switch that will turn the system on when the implement is lowered. It can be turned on and off with a Master On/Off Switch (footswitch or on-screen). The system can also be turned on and off using Task Control to turn the system (or sections) on and off as the implement enters the field or overlaps previously applied areas using GPS location information.

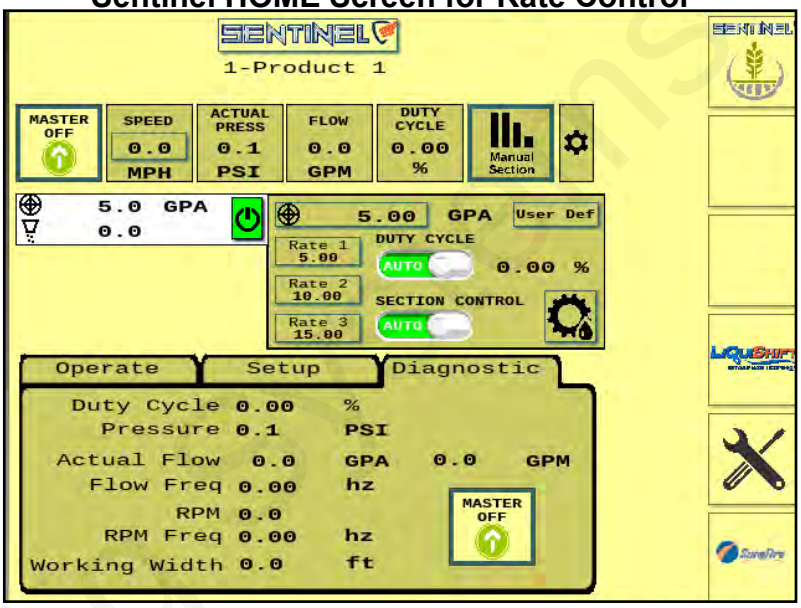
Sentinel Wheat (Home) Button

On the HOME screen, the top row is a Customizable Toolbar with options to display several different system parameters.

The center section shows the Rate Control operation for each product. The user defined rates are available for selection on the go.

The bottom section has 3 tabs. Watching the information on the Diagnostic tab will help the user become familiar with normal operating parameters. Knowing what is normal can help the operator diagnose and fix the issue if a problem occurs.

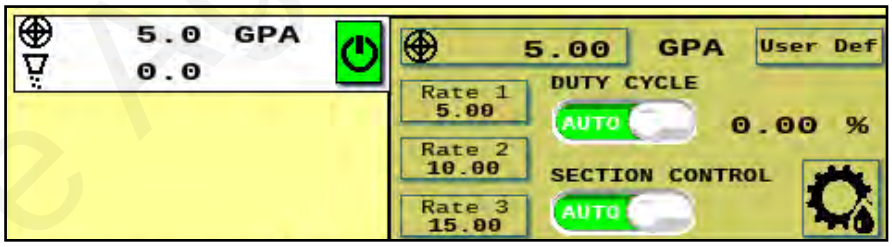
Sentinel HOME Screen for Rate Control



Center Section - If operating more than one product, all products will be shown on the left side of this section.

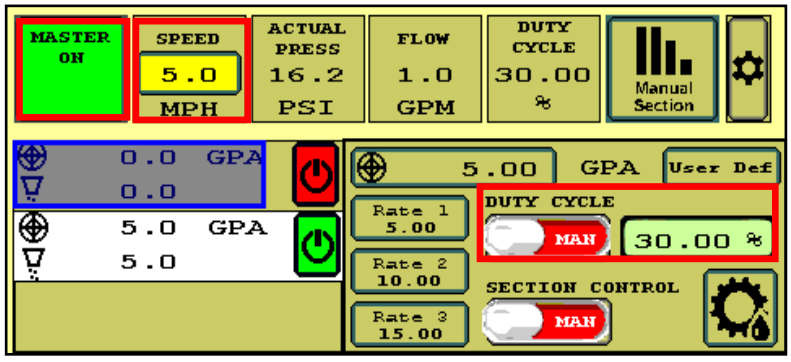
Normal operation is with Duty Cycle and Section Control set to AUTO.

To run, there must be SPEED, Height Switch down, Master ON, target rate set, and a working width.



Toggle between Rate 1, 2, and 3 on the go, or press the top Target Rate box and enter a different target. Press the gear/teardrop on the bottom right to go to the Rate Setup screen.

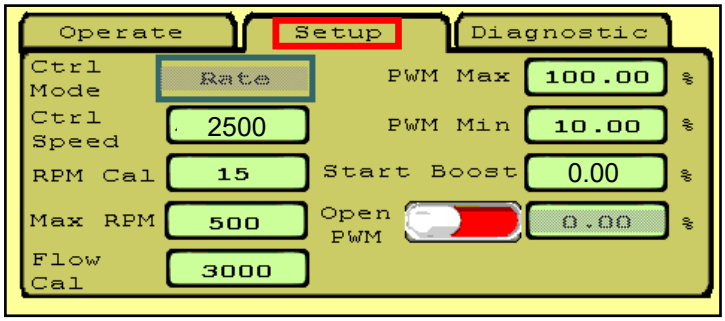
To operate manually, press **Speed**, enter a speed, select **DUTY CYCLE MAN**, enter a **DC%** (minimum of 15 for electric, minimum of 30 for hydraulic),
Section Control: MAN. **Master: ON.**
Height switch: DOWN (if used)



To test the system, you can change the Duty Cycle % as the pump is running. Observe the Flow (GPM) and Pressure with each Duty Cycle %. On an electric pump system, you can do this with one pump plugged in at a time to verify the operation of each pump. Look at the Diagnostic tab for more information.

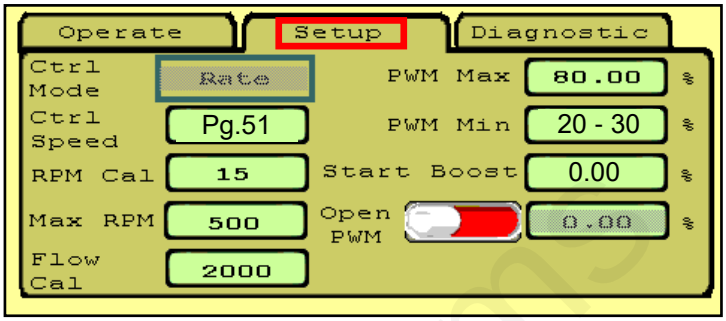
Sentinel HOME Screen for Rate Control -- Setup and Diagnostic Tabs

Setup values are shown for typical **electric** pump system. These can be adjusted as necessary for best operation.



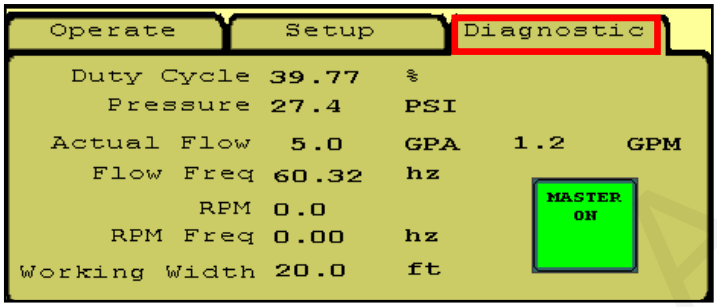
Ctrl Speed: Decrease if pump surges or oscillates back and forth above and below the rate. Increase if pump is slow to adjust. See page 51 for hydraulic pump settings.
RPM is not used with electric pumps.
Start Boost - 0 (pump starts where it stopped) or set in field (enter PWM DC % for startup speed)

Setup values are shown for typical **hydraulic** pump system. These can be adjusted as necessary for best operation.



Flow Cal can be adjusted slightly if an accurate catch test or field verification indicates it should. Increase Flow Cal if more product is needed. Decrease flow cal if less product is needed.
Decrease **PWM Min** if pump will not slow down enough for low speed/rate/width.

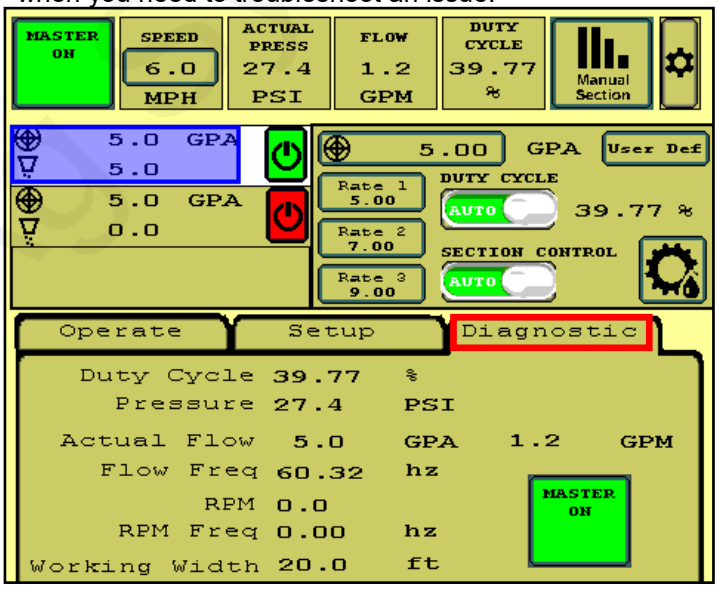
Diagnostic is a screen that can be seen while operating in the field or while testing. The important system parameters can be seen here.



Diagnostic Tip: Note the relationship between Duty Cycle (%), Pressure, Flow (GPM), and RPM (hydraulic pump). If Duty Cycle and RPM increase above what Is normal for a given flow, there could be a restriction on the inlet side of the pump. This could be a plugged strainer or a strainer that gets gelled over, especially with cold fertilizer.

Increased Duty Cycle with no increase in RPM could mean the pump is not getting enough hydraulic flow to spin the pump faster.

Check the **Diagnostic** screen regularly so you have an idea what “normal” operating numbers are. This can help when you need to troubleshoot an issue.



Diagnostic: (PWM) **Duty Cycle** shows the PWM signal sent from the controller to control the pump. On a hydraulic system, this needs to be around 30% before the pump will run. 40%- 50% is a typical operating range. On a normal pass this should be fairly stable (± 2%). The Duty Cycle will adjust for speed, rate changes or width changes (sections going on and off).
Actual Flow shows the GPA being applied based on the Speed and the Machine Width.
Flow is the GPM measured by the flowmeter.
Flow Freq shows the number of pulses per second (hz) being received from the flowmeter. This should be fairly stable (± 2). When diagnosing flowmeter issues, watch this number during a tap test to see if the signal gets from the flowmeter harness connector to the display.
RPM shows the pump RPM on a hydraulic pump equipped with an RPM sensor. This should be less than 500. Can be set at 550 if maximum pump output is required. **RPM Freq** shows the signals received from the RPM sensor. This can also be used during a tap test on the Pump RPM harness connector.
Watch these values regularly during operation so you know what “normal” looks like. For example, a plugged strainer could mean the pump has to run faster than normal to get enough product. This will show up in an increased Duty Cycle and RPM.
Working Width will change as sections turn on and off. It should show the application width at any time.

Setting Up a System With

Sentinel Rate Control
and
Sentinel Row Flow Monitoring

226-01-3547Y1
Sentinel ISOBUS ECU

Typically will use one of the following Sentinel ECU Harnesses

For Rate Control **without Gen 3 LiquiShift**

208-06-5022Y1	Sentinel Row Control and Flow Monitoring ECU Harness- 2 products - 18 sections
208-06-4099Y4	Sentinel Row Control and Flow Monitoring ECU Harness - 2 products - 18 sections
208-06-4984Y2	Sentinel Row Control and Flow Monitoring ECU Harness - **4 products** - 18 sections

For Rate Control **with Gen 3 LiquiShift**

208-06-5023Y1	Sentinel Row Control and Flow Monitoring ECU Harness - **Gen 3 LiquiShift** - 2 PR - 16 sect
208-06-4701Y2	Sentinel Row Control and Flow Monitoring ECU Harness - **Gen 3 LiquiShift** - 2 PR - 16 sect
208-06-4985Y1	Sentinel Row Control and Flow Monitoring ECU Harness - **Gen 3 LiquiShift - 4 PR -** 16 sect

Sentinel Setup and Configuration

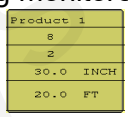
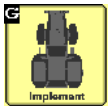
Set-up and Configuration for Rate Control & Row Monitoring

D
Setup & Operation

The following pages will guide you through the initial set-up and configuration of your Sentinel Rate Control & Row Monitoring system. Below is an overview of the steps necessary to fully configure the system before operation. Each subsequent page outlines the page features as well as the sequence of buttons used to navigate to that page from the HOME screen.

Basic Steps for Initial System Set-up for Rate Control & Row Monitoring

For detailed information on a step, go to the referenced page

REFERENCE Page #	STEP
64	1. Press the **HOME** button 
64	2. Go to the settings page by touching the **SETTINGS** button 
64	3. On the settings page, specify the number of products being monitored (maximum of 4)
64-65	4. Configure each product by touching the **PRODUCT** button 
64	5. Select DEVICE *(Liquid Rate Control + Monitor)* and set up each product (sections, rows,…)
65	6. Press **MORE**, set up Rate (USER DEF), Smoothing (10%), other options for this setup.
	7. When finished, use the BACK arrow to go back to the SETTINGS menu.
66	8. Set up the implement dimensions by touching the I**MPLEMENT** button. 
66	9. Choose a speed source by selecting the **SPEED** button. 
66	10. Select system control options (task control, lift switch, etc.) under **HARDWARE.** 
67(65)	11. Select the Rate Mode (*USER DEF)* at **RATE SETUP.** 
67-68	12. From the Settings screen, touch the **NEXT** button. 
68	13. Click on **Flow Module Diagnostics**
68	14. Ensure that all flow modules are plugged in and click **Reset All Addresses**
	15. Unplug all of the Sentinel Flowmeter Modules.
	16. Beginning with module #1 (on Product 1), plug it back in - module 1 should turn green on the screen. Have someone watch the screen to verify successful addressing for each module.
	17. Moving across the implement, plug in each module for Product 1 in order.
	18. If applicable, address the modules for product 2 by repeating steps 15-16 for product 2.
	19. Select the correct module orientation (**ABCD** or **DCBA**) (What is Row 1? (A) or (D)?
69	20. Customizing Scans and Alarms

Sentinel Setup and Configuration

Set-up and Configuration for Rate Control & Row Monitoring

D
Setup & Operation

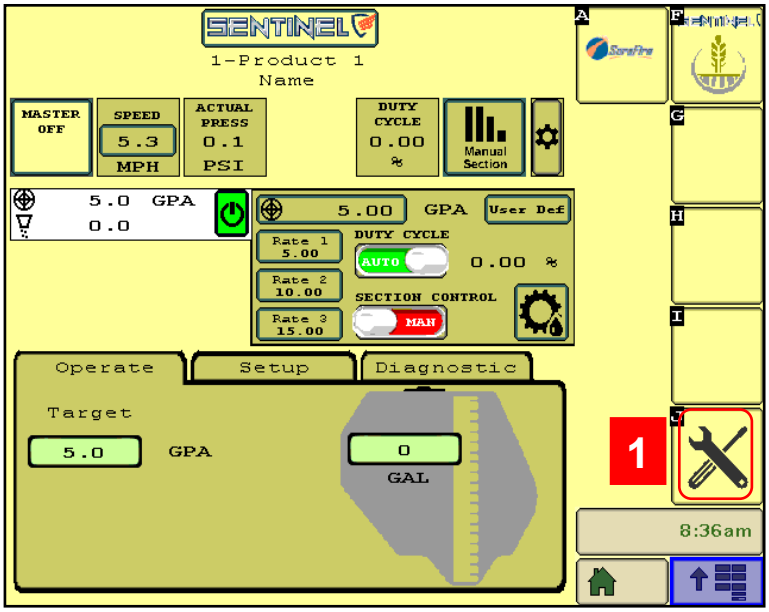
The following pages will guide you through the initial set-up and configuration of your Sentinel Rate Control & Row Monitoring system. Below is an overview of the steps necessary to fully configure the system before operation. Each subsequent page outlines the page features as well as the sequence of buttons used to navigate to that page from the HOME screen.

Basic Steps for Initial System Set-up for Rate Control & Row Monitoring

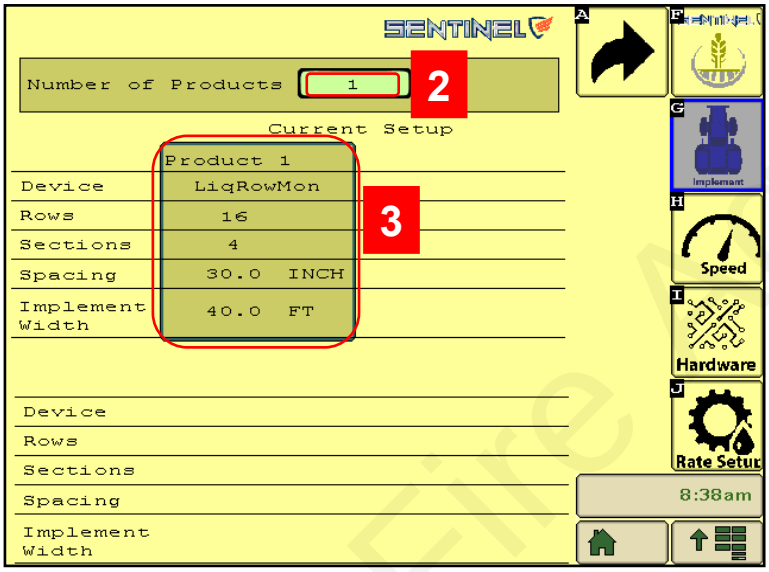
For detailed information on a step, go to the referenced page

REFERENCE Page #	STEP
70	21. Setup settings for Rate Control - Control Speed, Flow Cal, PWM Max and Min
70	22. Software Version and Auxiliary Settings Screens
71	23. Row Detail Screen
72	24. Customizable Toolbar and Totalizer Counters
73-75	25. Rate Control & Row Monitoring Run Screen and Operation & Setup Summary
76	26. Nozzle Test - Simulated speed and rate test
77-78	27. Catch Test - Verify and adjust flowmeter calibration

SETUP for Rate Control & Row Flow Monitoring - Settings - Product - Device



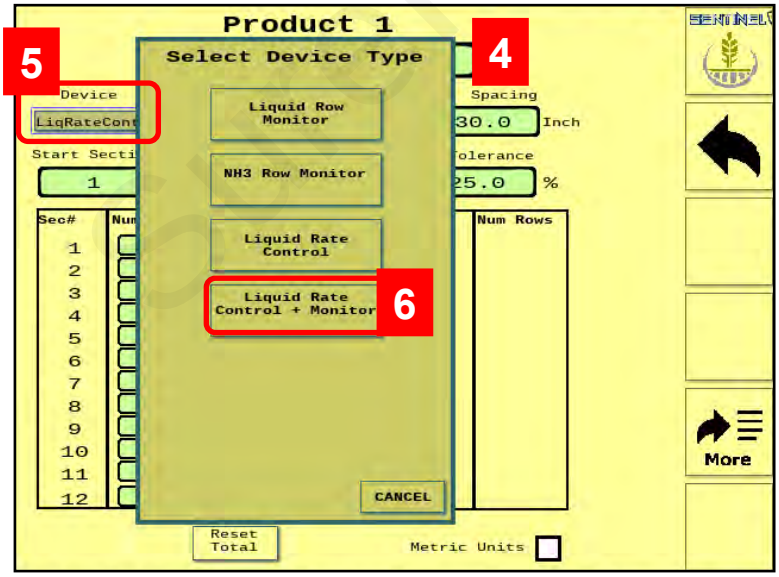
1.) Press the **SETTINGS** Tools button to go to the System Configuration screens.



2.) Enter the **number of products** that will be monitored or controlled with the Sentinel.

3.) Press the big **Product 1** box.

(If the system has two products, there will be a Product 2 box to the right of Product 1. Set up Product 2 in a similar fashion to what is shown for Product 1.)

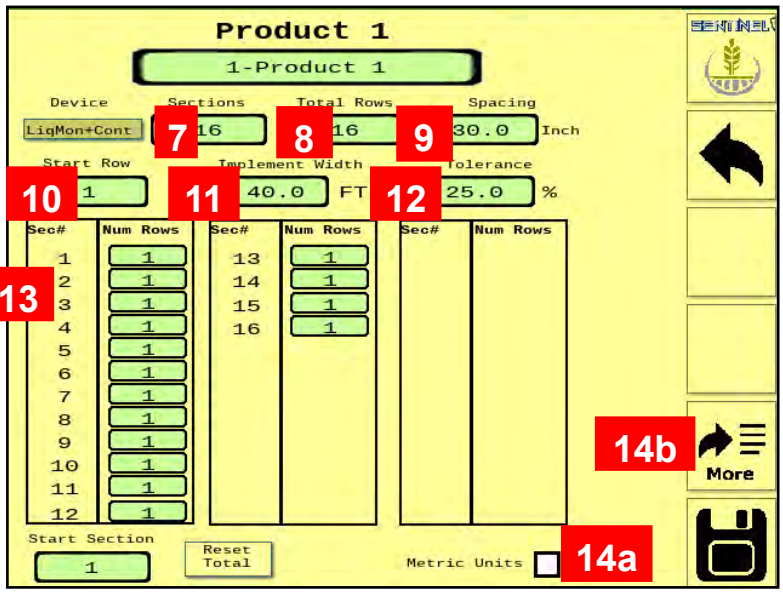


4.) Enter a name for the Product.

5.) Press the box under "**Device**".

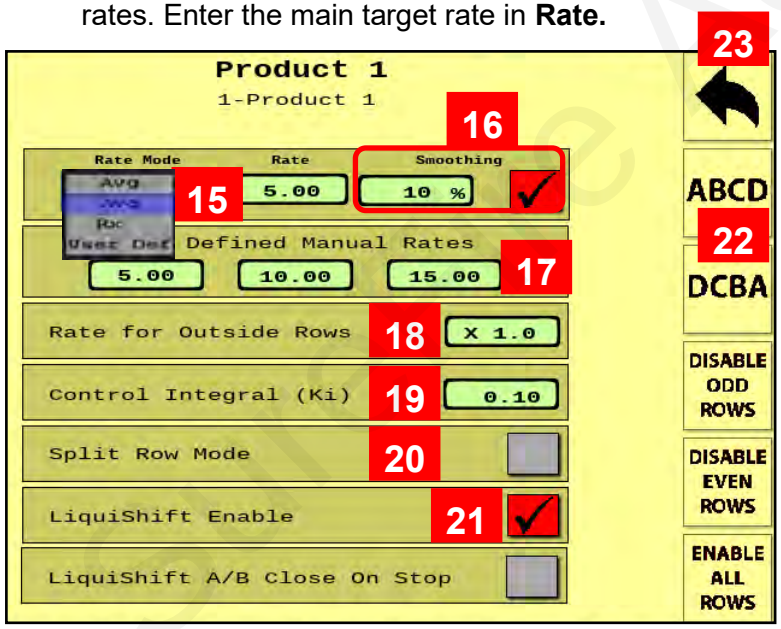
6.) Select "**Liquid Rate Control + Monitor**" to use the Sentinel for Rate Control and to use the Sentinel flowmeter modules for row flow monitoring.

SETUP for Rate Control & Row Flow Monitoring



14a.) Check this box for **Metric Units**.

15.) See below: **Rate Mode** - For rate control, set this to **Rx** (for prescriptions) or to **User Def** to enter preset rates. Enter the main target rate in **Rate.**



23.) Press the **Back Arrow** when finished with this screen.

Rate Setup screen from v 1.3.0.

7.) Enter the number of **SECTIONS** for this product.

8.) Enter the number of **ROWS** for this product.

9.) Enter the row spacing in **INCHES**.

10.) **Start Row** = 1 for Product 1.

Product 2 Start Row will typically be 1 more than the number of Rows on Product 1. On a 16-row system, Product 2 will start with Row 17.

11.) Enter **Implement Width** in FT.

12.) **Tolerance** - start at 25%. You can lower this in the field. If the tolerance is too low, there will be unnecessary alarms. The Row Bar Graph will show red if a row is off-rate by the Tolerance % or more.

13.) Verify the number of rows in each section.

14b.) Press **More** to go to the next screen.

15.) See at left.

16.) **Smoothing** - Start with 10%. Typical setting will be from 5 to 15%. If the actual rate at any time is within this % of the Target Rate, the display will show the Actual Rate as being equal to the Target Rate.

The green line on the Row Bar Graph will not widen if the row variation is less than the Smoothing %. (See bottom picture for Rate Smooth and Row Smooth on v. 1.3.0)

17.) You can enter up to 3 user-defined rates. These can also be entered on the Rate Setup screen.

18.) **Rate for Outside Rows** is typically “X 1.0”.

Some applications may be “X 0.5” (half-rate) or “X 1.5” (rate and a half) for outside rows.

19.) **Split Row Mode** -

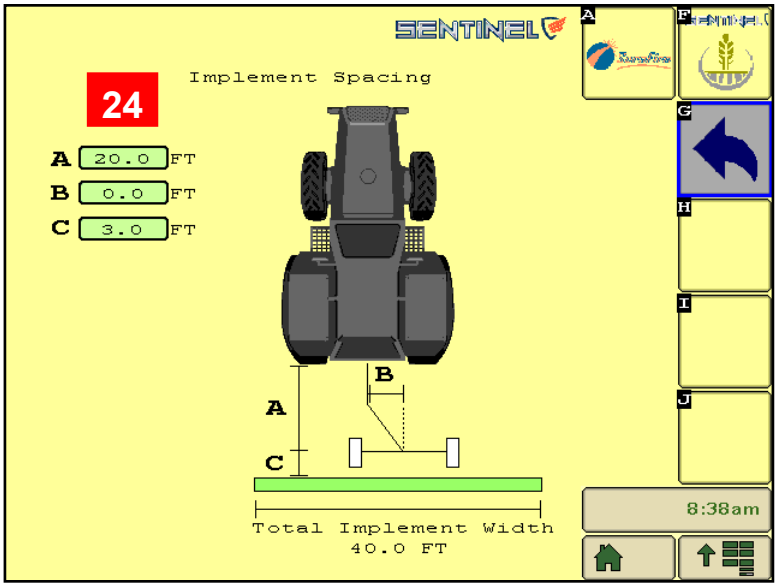
20.) **LiquiShift Enable** - Check this box if Sentinel is controlling LiquiShift on this product. (LiquiShift A-B valves can be controlled by a black LiquiShift Control Module on the back of the A-B Valve stack or can be plugged into and controlled by the Sentinel.)

21.) **LiquiShift A/B Close on Sto**p - Typically this is not checked.

22.) **Module Orientation - ABCD** if Row 1 is A. **DCBA** if Row 1 is D on the Sentinel flowmeter module.

16.) v1.3.0-Set Rate Smooth for Target Rate (top) and for Row Monitor (bottom).

SETUP for Row Flow Monitoring

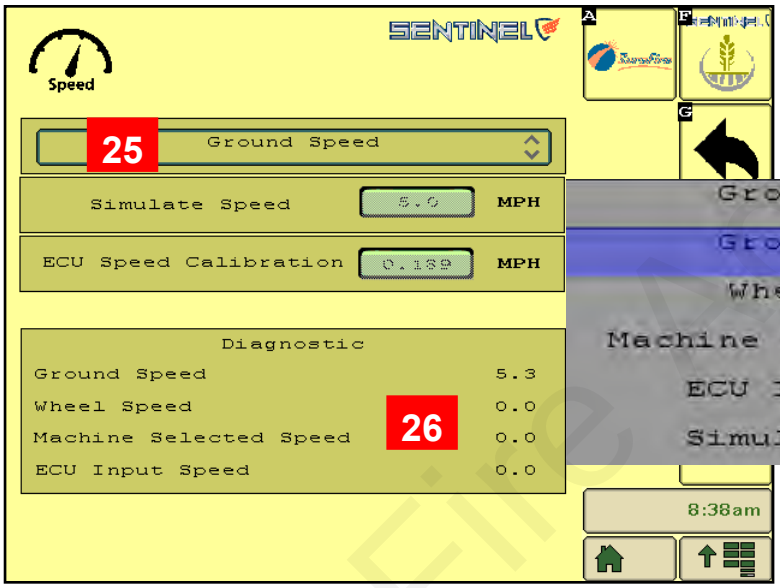


24.) Press **Implement** to enter and verify the Implement geometry.

The Implement dimensions are used when Task Control is enabled.

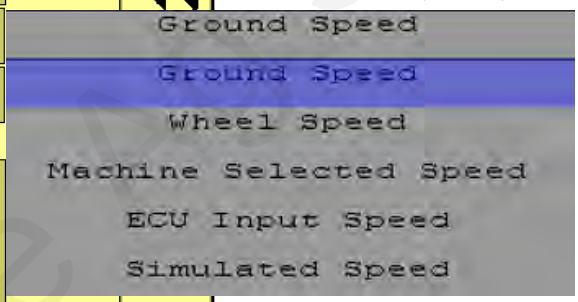
A = distance from GPS Antenna to Hitch
B = implement offset
C = distance from hitch to application point

Press the Back Arrow when finished.



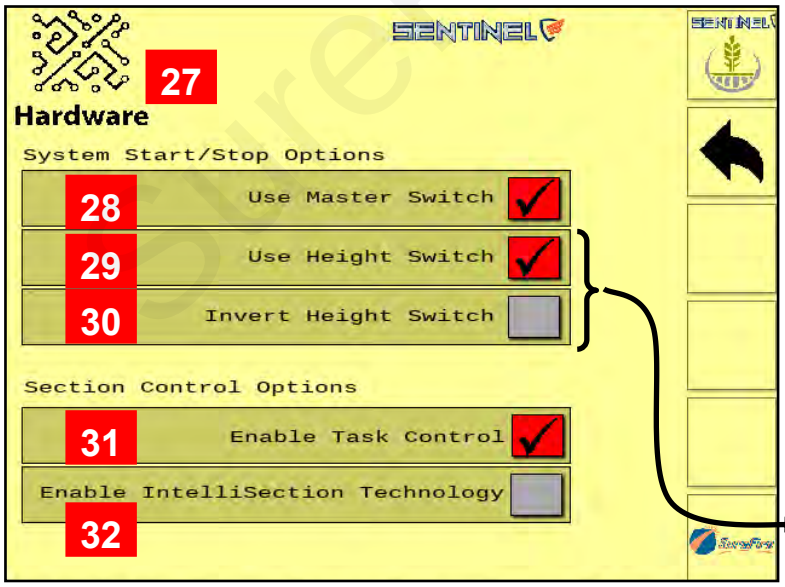
25.) On the right side, Press **Speed.**

Press the top box to select the Speed Source. This is typically Ground Speed.



26.) Check this box while moving to see which speed sources are reporting.

27.) On the right side, press **Hardware.**



28.) **Use Master Switch** - check this box if a dedicated Master Switch (Foot Switch) is plugged into Sentinel.

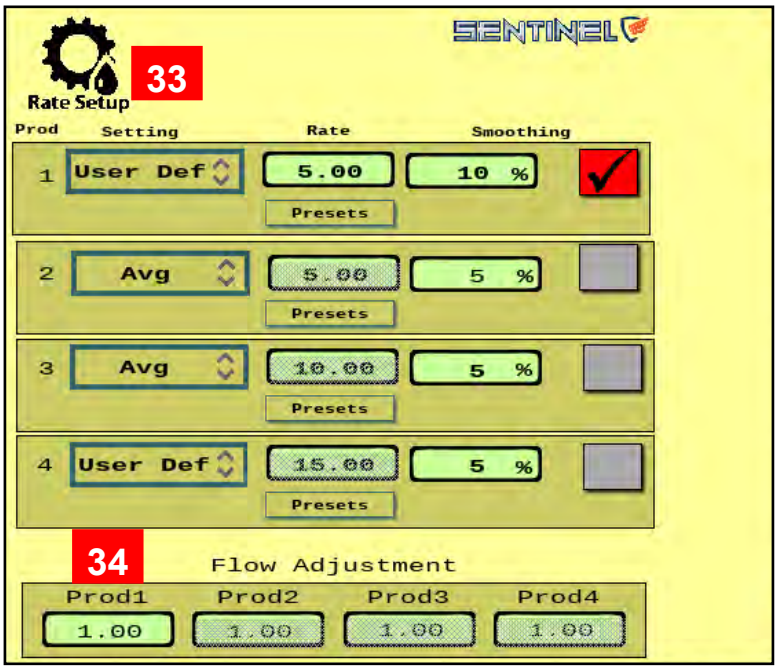
29.) **Use Height Switch** - Check this only if the Sentinel has a dedicated height switch.

30.) **Invert Height Switch** if necessary for correct orientation.

31.) **Enable Task Control** - normally used for rate control. Task Control must be activated on the display software.

32.) **Enable Intellisection Technology** - normally not used in this setup.

SETUP for Rate Control & Row Flow Monitoring - Rate Setup - Flow Adjustment - 2 Products



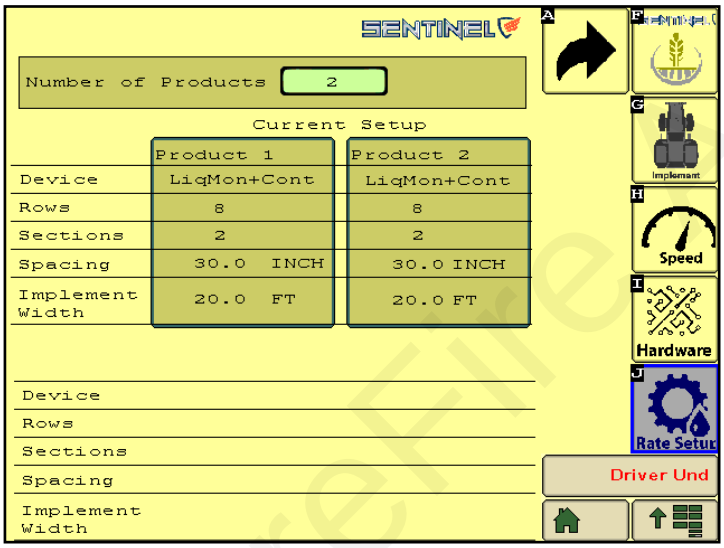
33.) For Rate Control verify the Setting is Rx or User Def. Smoothing usually starts at 10%. Use Presets to enter up to 3 rates.

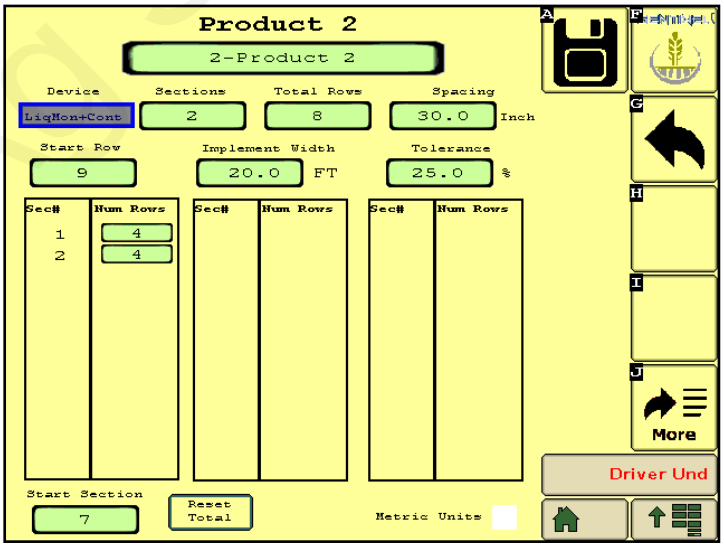
34.) **Flow Adjustment** - Use this to synchronize the Sentinel flowmeter modules with the main system flowmeter. Once the accuracy of the main flowmeter has been confirmed, change the Flow Adjustment factor as needed to synchronize the Sentinel reading with the main flowmeter reading.

$$\frac{\text{Main Flowmeter GPM}}{\text{Sentinel Total Flow GPM}} = \text{Flow Adjustment Factor}$$

(If different from 1.00, this should not be much different. Generally, will be between 0.95 and 1.05.)

SETUP for 2 products with Rate Control and Row Flow Monitoring





If you are setting up Sentinel to do rate control and row monitoring on 2 products your screen will look like this. You will need to go through the setup steps for both Product 1 and Product 2.

Product 2 will usually start with the next row after Product 1, so if Product 1 has 8 rows, Product 2 will start with Row 9.
Product 2 may start with Section 7 if the main harness has connectors for Sections 1-6 and Sections 7-12.

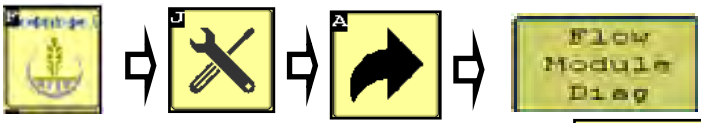
Gen3 LiquiShift systems may have different section setups. Check the section harness to see which section the last row is assigned to in order to determine total number of sections.

12 rows	12 sections	**Gen3 LiquiShift**		12 rows	6 sections
16 rows	16 sections	One product	Two Products	16 rows	8 sections
24 rows	12 sections			24 rows	8 sections

Sentinel Setup and Configuration

D
Setup & Operation

Addressing Sentinel Flow Modules



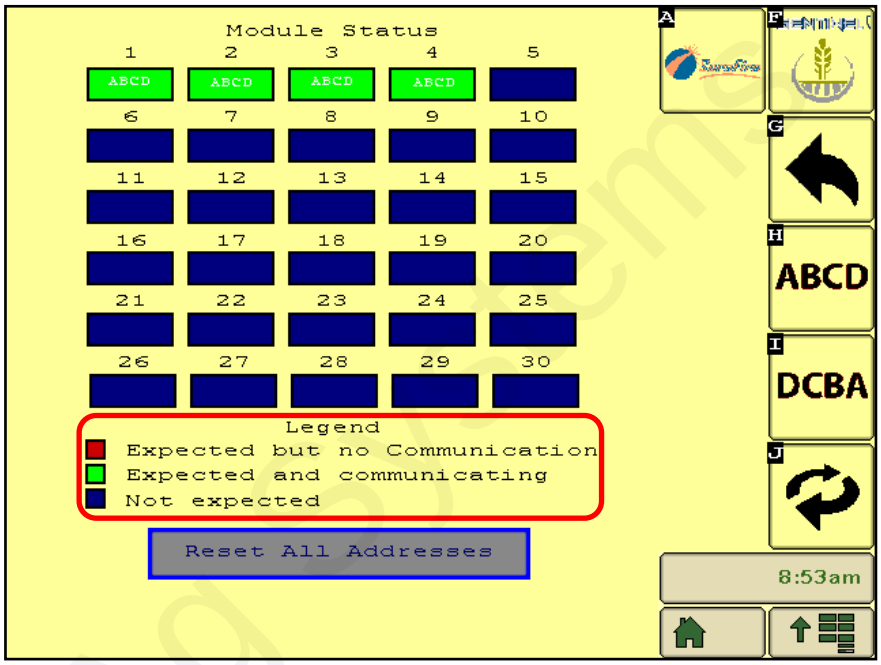
Flow Module Diagnostics

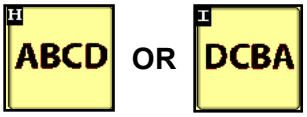
To address the Sentinel flow modules, start by having all the modules plugged in. From this screen, push **Reset All Addresses**. This sends a message to the modules to erase their address. All modules for Product 1 are then unplugged and then plugged back in, in order across the machine. As each module is plugged in, Sentinel identifies it's location on the machine and the module is then given its new address and it will turn green on the screen. *Have someone watch this screen to be sure each module is recognized as it is plugged in.*

Once all modules are addressed, choose the proper **orientation** as described below.

Repeat for each Product.

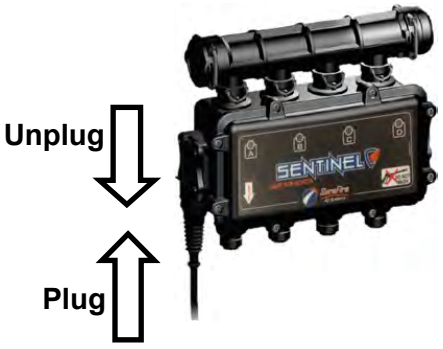
Flow Module Diagnostics Screen





Most machines will have the modules mounted facing forward, causing Row 1 to correspond with row D on the module. Therefore, the orientation DCBA must be selected. Likewise, if the modules are mounted rear-facing, the orientation ABCD will be selected.

Press the toggle button to go to the next page of modules



Example 16-Row—D C B A Orientation

Customizing Scans & Alarms, etc

This screen allows the user to change how row information is displayed on the HOME screen.

35.) When checked, the **Auto Scan** feature will scan through the product pages and/or rows on the HOME screen. You can change the length of time it stays on each page or row before advancing.

36.) **Auto Hide Alarms (if checked)** sets how long full-page alarms are displayed before they go away (see pg. 20)

37.) **Disable Alarms** - Check this to turn off alarms. May want to do this for testing or troubleshooting.

38.) **Alarm Time** - how long a row must be outside of the specified tolerance before the alarm sounds**.**

39. Re Alarm Interval - The time before the Alarm alarms again after being acknowledged. If the issue that triggered the alarm is not resolved, it will keep alarming at this interval until resolved (if the box is checked).

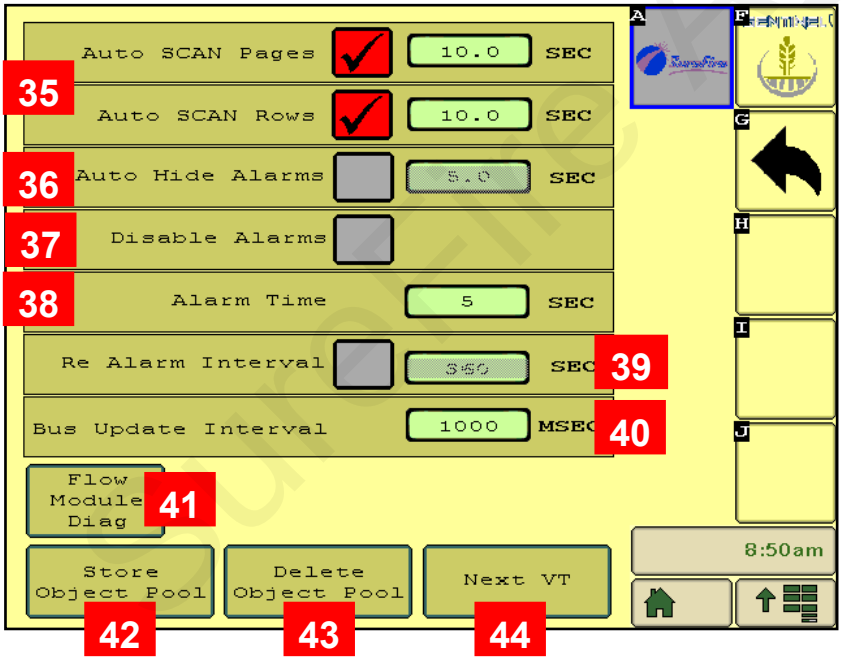
40. **Bus Update Interval -** Use this to slow down ISOBUS traffic if the BUS load is too high. *Reset only after talking to a SureFire representative.*

41.) **Flow Module Diagnostics** - Flow Module Diagnostics are addressed on previous page.

42.) **Store Object Pool** - Stores the current ISOBUS layout on the VT.

43.) **Delete Object Pool** - Deletes the current object pool on the VT and forces the monitor to regenerate the display when it is rebooted.

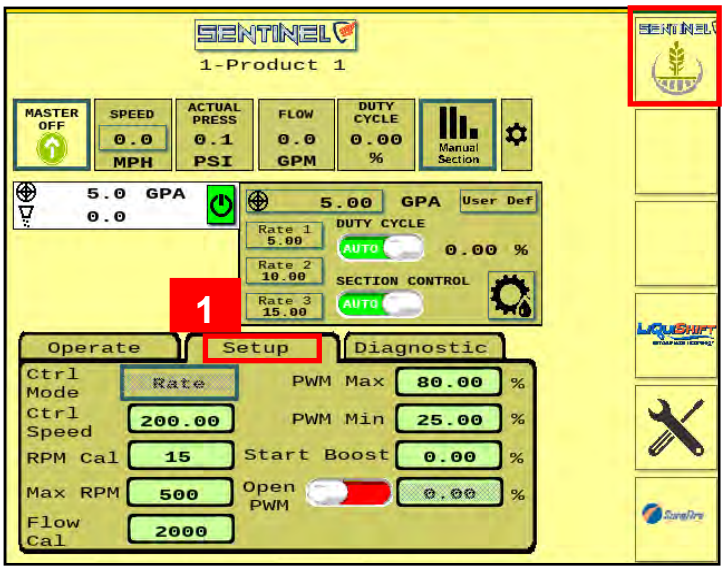
44.) **Next VT** - press to push Sentinel to another virtual terminal. This may be necessary if there is more than one monitor or display in the cab.



Next VT icon from v.1.3.0

Save to this VT from v.1.3.0

SETUP for Rate Control - SETUP - Control Speed - Flow Cal - PWM Max and Min



1.) Press the center **SETUP** tab.

Start with the following settings. Adjust as needed.

Ctrl Mode - RATE

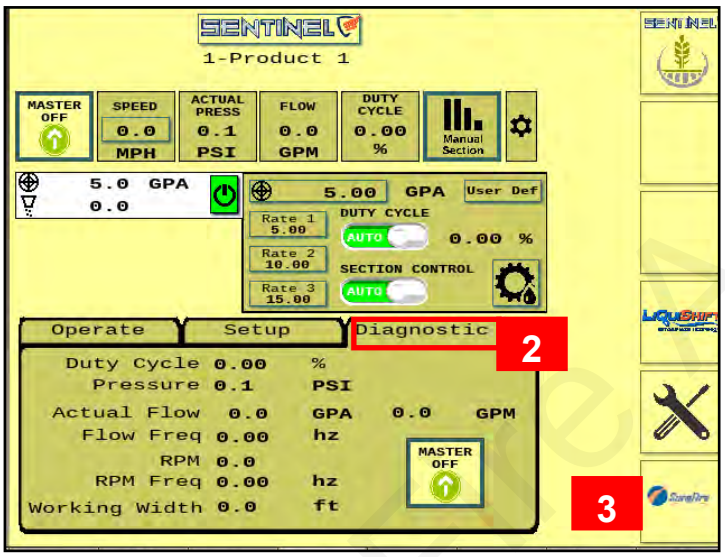
Ctrl Speed - PR17 - 250-300 PR30 - 200
PR40 - 160 D250 - 150
Tower Electric - 2000

Adjust as needed in the field. Increase the Ctrl Speed if the pump is slow to adjust. Decrease the Ctrl Speed if the pump fluctuates and will not lock on to the rate going across the field.

RPM Cal - 15 (for hydraulic pumps equipped with RPM sensor)

Max RPM - 500 (Can be set to 550 if needed)

Flow Cal - 2000 - most hydraulic pump systems
0.6 to 13 gpm flowmeter and larger.
3000 - most electric pump systems
0.3 to 5 gpm and smaller
(Flow cal number is on serial number sticker on side of flowmeter)



PWM Max - 80 to 100

PWM Min - 25 for most hydraulic pumps.
5-10 for most electric pumps.

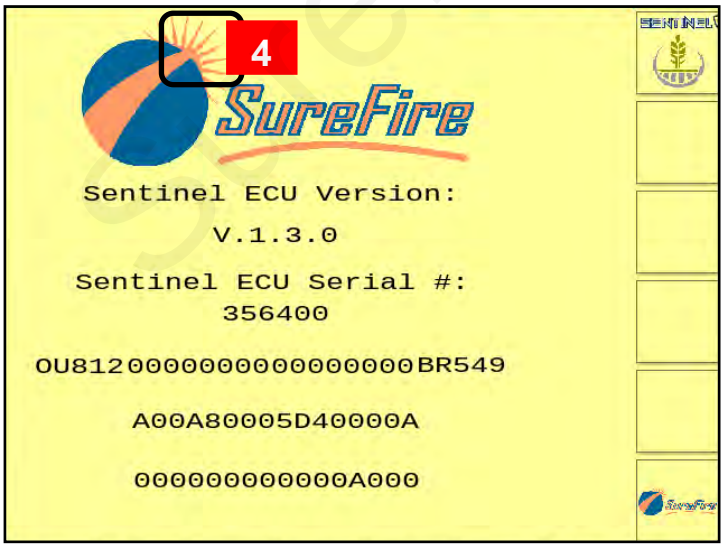
Start Boost - usually 0. Can be set slightly higher than normal PWM Duty Cycle for a startup boost.

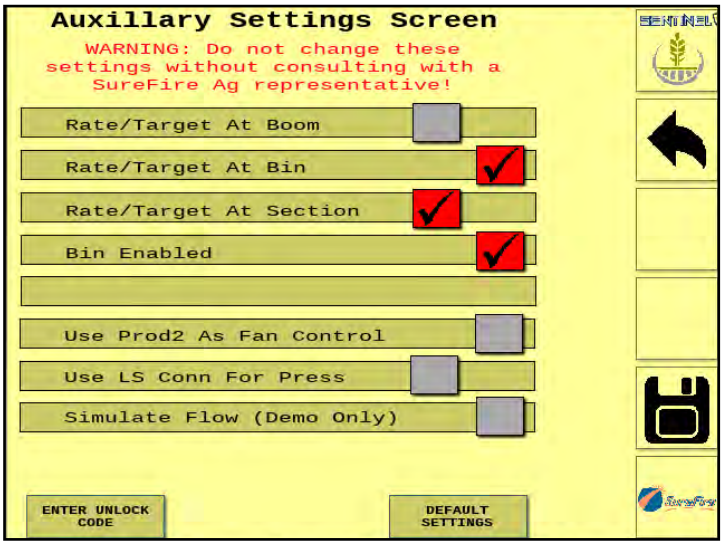
Open PWM - Normally RED. Turn to GREEN if you want the pump to continue running for product agitation while you turn around. When doing that, enter a PWM % to set the pump speed for agitation (usually 30-40%)

2.) DIAGNOSTIC TAB - Observe the system parameters during operation.

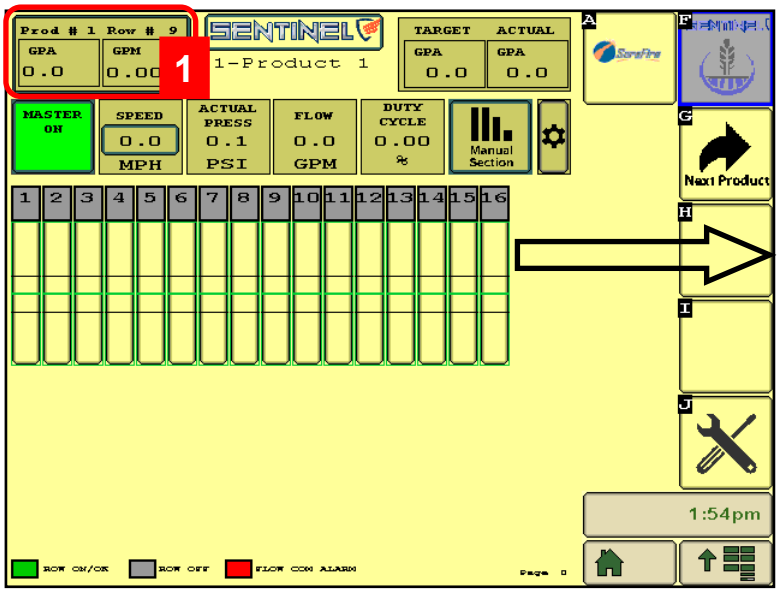
3.) **SureFire** - press for version information

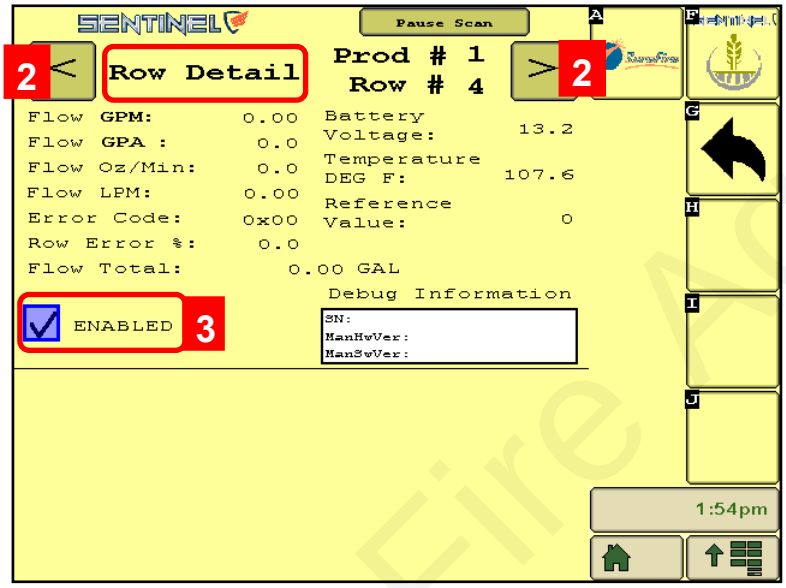
4.) Press starburst for Auxiliary Settings Screen.
Do not use this screen without authorization.





Row Detail Screen





1.) Pressing the Row Detail button (top left corner) on the Run screen brings up the Row Detail Screen.

The bar graph for Rows 1-16 shows the flow in each row at that instant.
A thin green line means the flow varies less than the Smoothing Factor % from the correct amount.
A thicker green line means the flow on that row varies by more than the Smoothing Factor % but less than the Tolerance %.
A red bar indicates the flow on that row varies by more than the Tolerance % set up for that product.
Example: Smoothing Factor - 10%
Tolerance - 20%
Flow less than 10% variance - thin green line
Flow with 10-19% variance - thicker green band
Flow more than 20% variance - red band

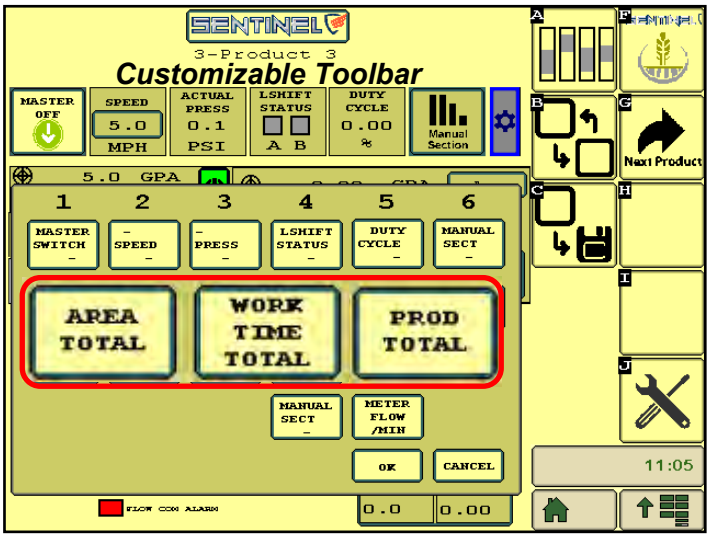
2.) Press the Left Arrow or Right Arrow to see details for other rows.

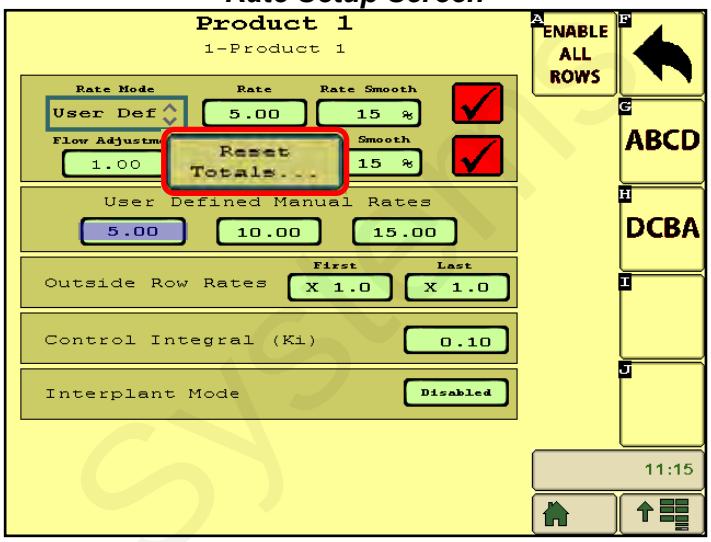
3.) A Row can be ENABLED or DISABLED by checking or unchecking the **ENABLED** box.

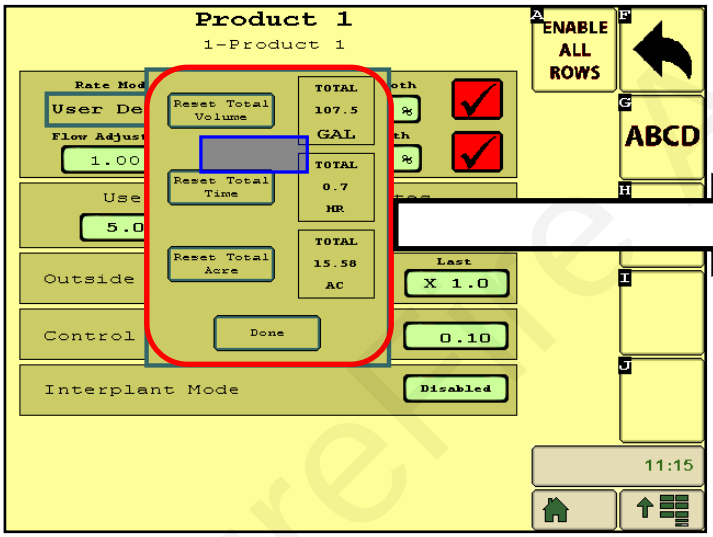
Customizable Toolbar & Totalizer Counters - Acres - Hours - Gallons

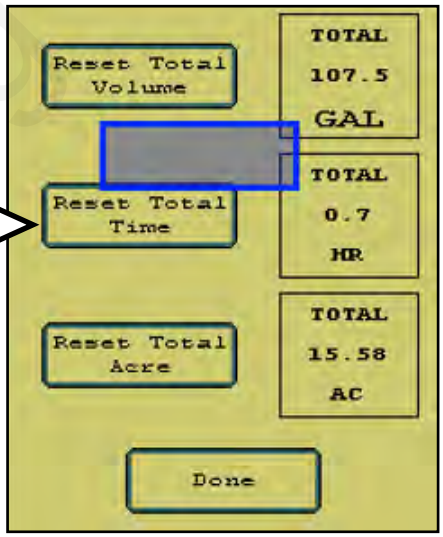
Sentinel has 3 totalizer counters to keep track of acres, hours, and gallons.
Any of these may be set up on the Customizable Toolbar near the top of the Product Run Screen. If these are not on the Customizable Toolbar, the values may still be seen by pressing the *Reset Totals* button on the Rate Setup screen. The items may be individually reset to 0 by pressing the Reset Total button for that item, or the totals may be left unchanged by returning to the Run Screen without resetting the values.

Rate Setup Screen



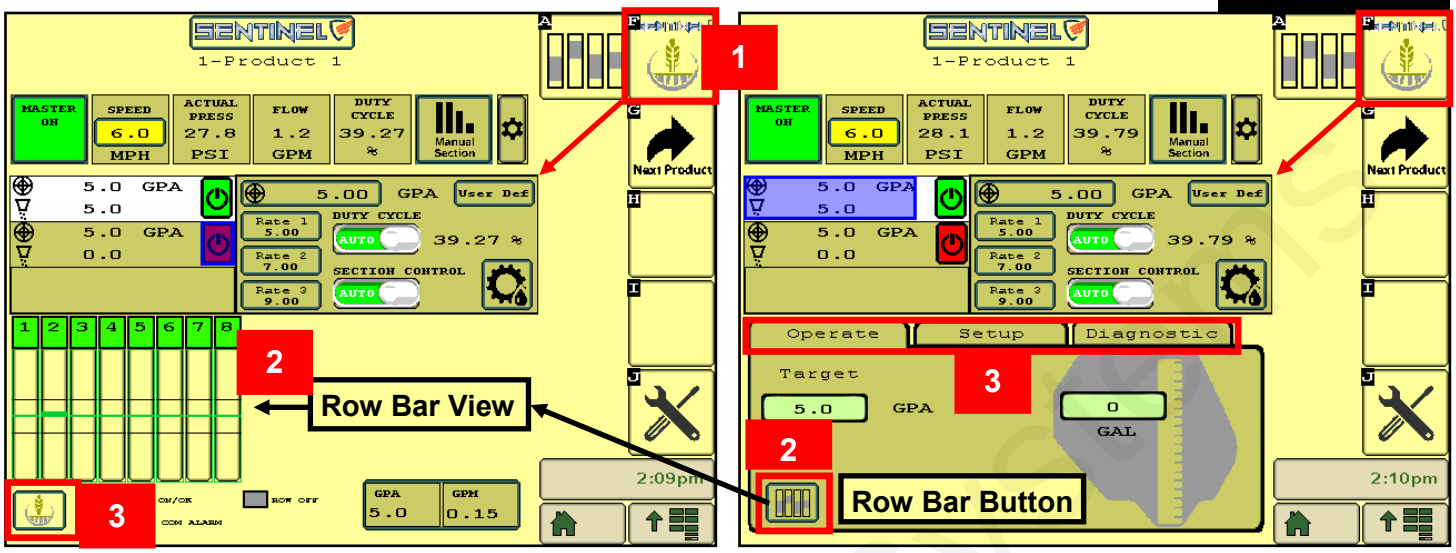






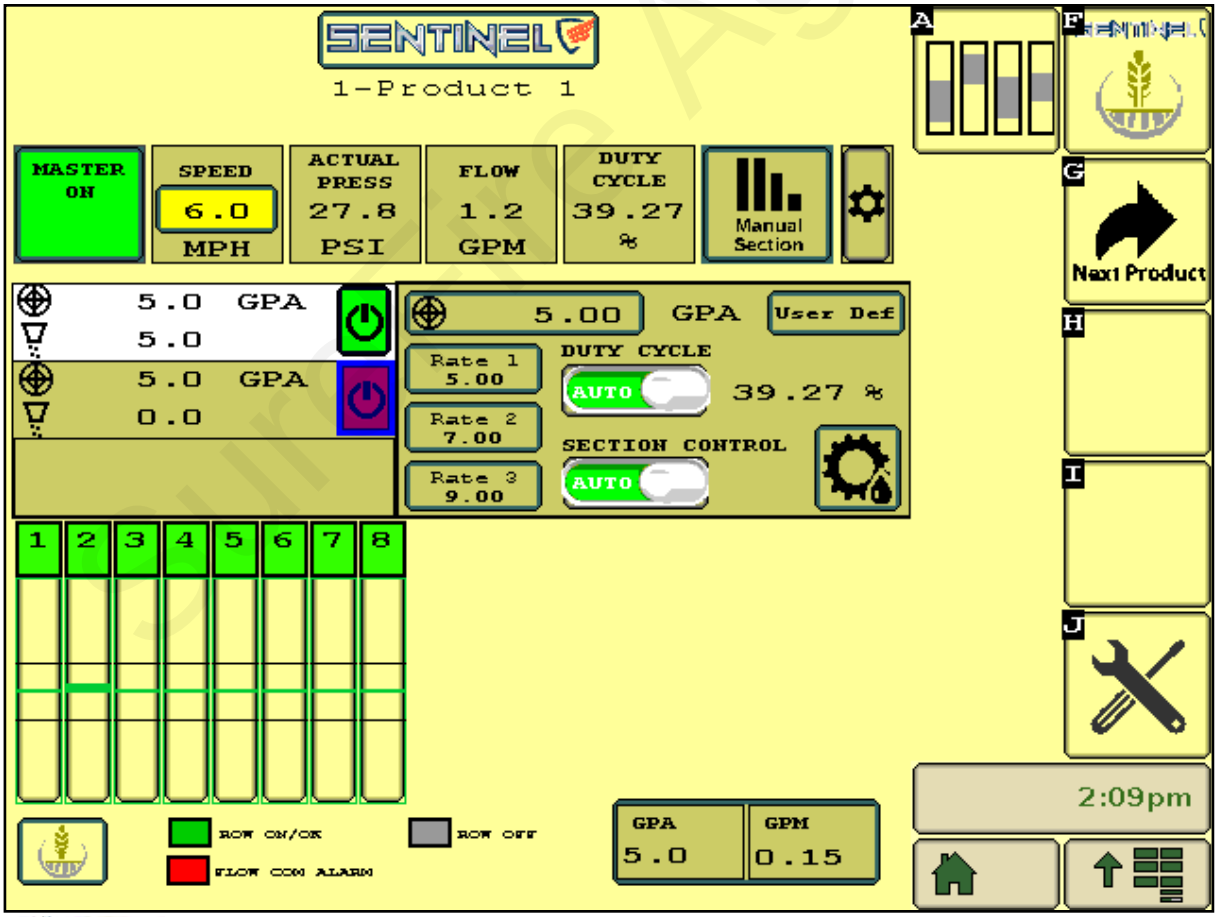
Sentinel Rate Control & Row Monitoring Operation

1.) When operating with RATE CONTROL **and** ROW FLOW MONITORING, the Wheat button in the **top right corner** gives you the top half of the screens below.



2.) Pressing the **Row Bar Button** in the **lower left corner** gives you the Row Bar View on the bottom half of the screen.3.) Pressing the **Wheat button** in the **lower left corner** gives you the bottom half of the screen with Operate > Setup > Diagnostic tabs/

Typical Run Screen view for Rate Control & Row Monitoring Operation



Sentinel Rate Control Operation

Once the Sentinel has been set up in the display, little is required of the user to operate the Sentinel. The system can be started with an Implement Switch that will turn the system on when the implement is lowered. It can be turned on and off with a Master On/Off Switch (footswitch or on-screen). The system can also be turned on and off using Task Control to turn the system (or sections) on and off as the implement enters the field or overlaps previously applied areas using GPS location information.

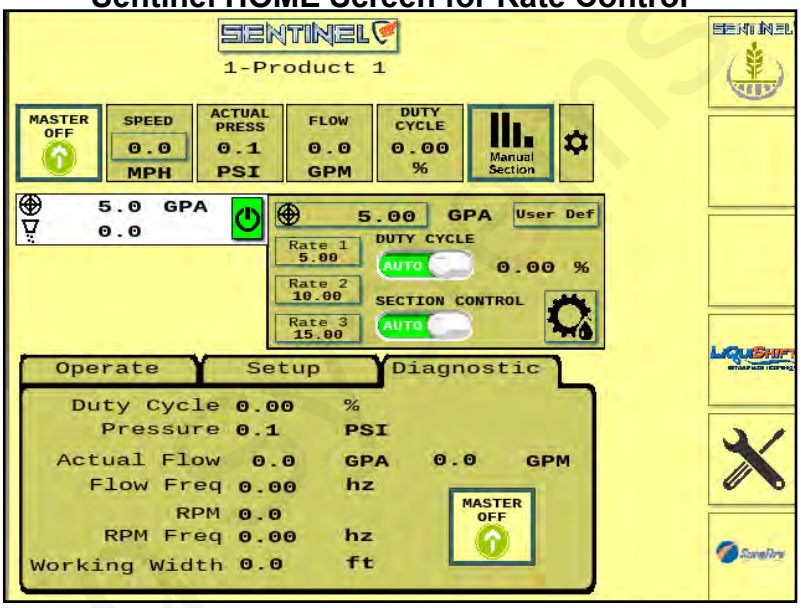
Sentinel Wheat (Home) Button

On the HOME screen, the top row is a Customizable Toolbar with options to display several different system parameters.

The center section shows the Rate Control operation for each product. The user defined rates are available for selection on the go.

The bottom section has 3 tabs. Watching the information on the Diagnostic tab will help the user become familiar with normal operating parameters. Knowing what is normal can help the operator diagnose and fix the issue if a problem occurs.

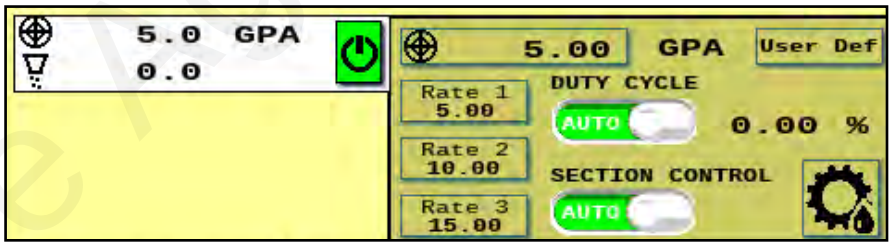
Sentinel HOME Screen for Rate Control



Center Section - If operating more than one product, all products will be shown on the left side of this section.

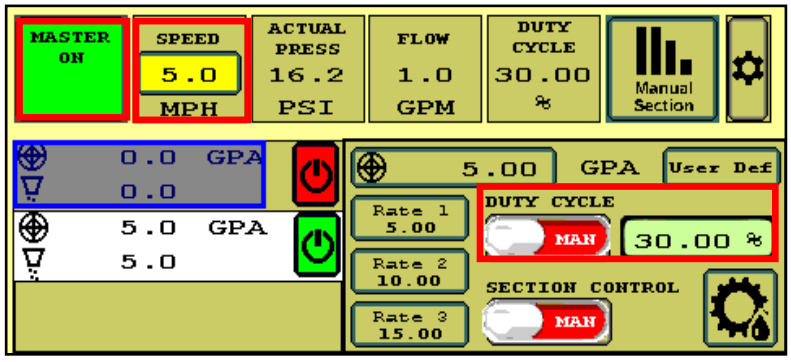
Normal operation is with Duty Cycle and Section Control set to AUTO.

To run, there must be SPEED, Height Switch down, Master ON, target rate set, and a working width.



Toggle between Rate 1, 2, and 3 on the go, or press the top Target Rate box and enter a different target. Press the gear/teardrop on the bottom right to go to the Rate Setup screen.

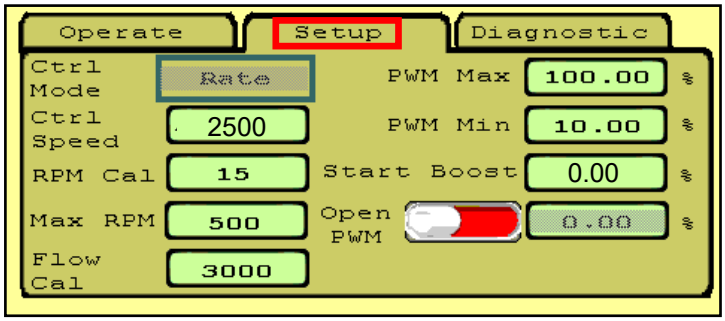
To operate manually, press **Speed**, enter a speed, select **DUTY CYCLE MAN**, enter a **DC%** (minimum of 15 for electric, minimum of 30 for hydraulic),
Section Control: MAN. **Master: ON.**
Height switch: DOWN (if used)



To test the system, you can change the Duty Cycle % as the pump is running. Observe the Flow (GPM) and Pressure with each Duty Cycle %. On an electric pump system, you can do this with one pump plugged in at a time to verify the operation of each pump. Look at the Diagnostic tab for more information.

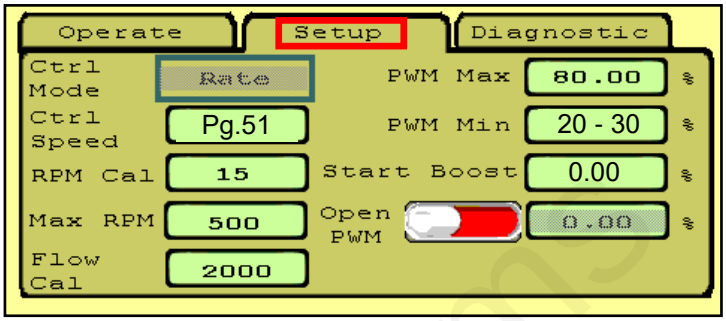
Sentinel HOME Screen for Rate Control -- Setup and Diagnostic Tabs

Setup values are shown for typical **electric** pump system. These can be adjusted as necessary for best operation.



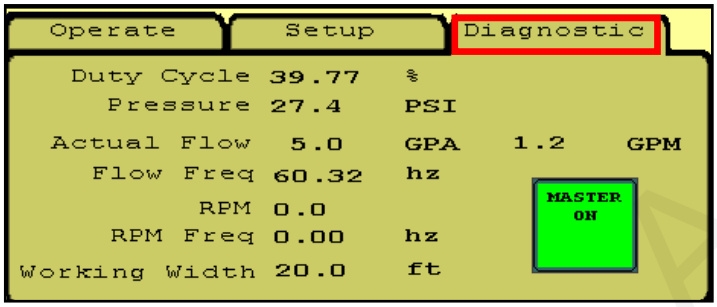
Ctrl Speed: Decrease if pump surges or oscillates back and forth above and below the rate. Increase if pump is slow to adjust. See page 51 for hydraulic pump settings.
RPM is not used with electric pumps.
Start Boost - 0 (pump starts where it stopped) or set in field (enter PWM DC % for startup speed)

Setup values are shown for typical **hydraulic** pump system. These can be adjusted as necessary for best operation.



Flow Cal can be adjusted slightly if an accurate catch test or field verification indicates it should. Increase Flow Cal if more product is needed. Decrease flow cal if less product is needed.
Decrease **PWM Min** if pump will not slow down enough for low speed/rate/width.

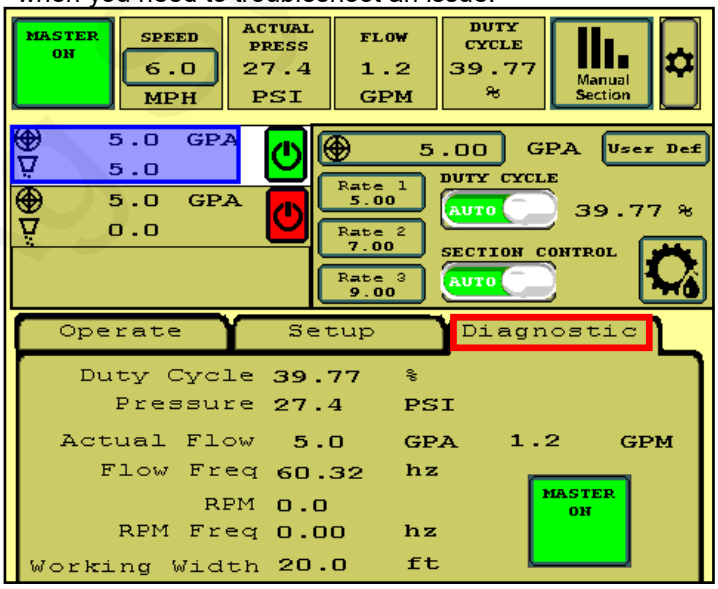
Diagnostic is a screen that can be seen while operating in the field or while testing. The important system parameters can be seen here.



Diagnostic Tip: Note the relationship between Duty Cycle (%), Pressure, Flow (GPM), and RPM (hydraulic pump). If Duty Cycle and RPM increase above what Is normal for a given flow, there could be a restriction on the inlet side of the pump. This could be a plugged strainer or a strainer that gets gelled over, especially with cold fertilizer.

Increased Duty Cycle with no increase in RPM could mean the pump is not getting enough hydraulic flow to spin the pump faster.

Check the **Diagnostic** screen regularly so you have an idea what “normal” operating numbers are. This can help when you need to troubleshoot an issue.

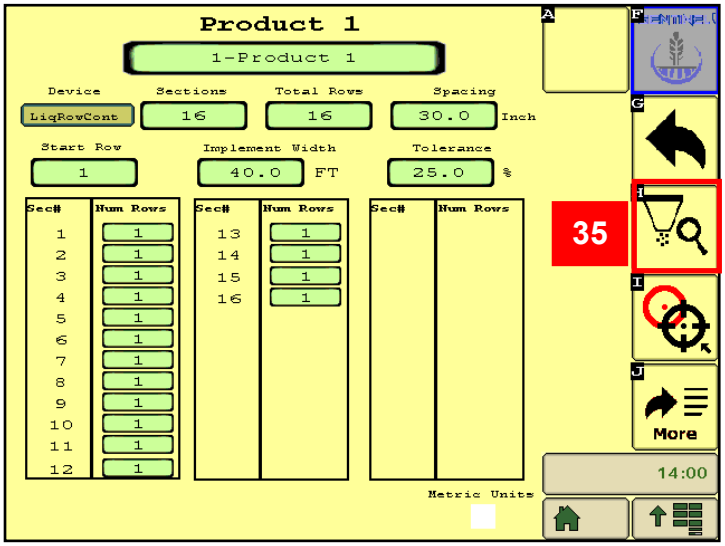


Diagnostic: (PWM) **Duty Cycle** shows the PWM signal sent from the controller to control the pump. On a hydraulic system, this needs to be around 30% before the pump will run. 40%- 50% is a typical operating range. On a normal pass this should be fairly stable (± 2%). The Duty Cycle will adjust for speed, rate changes or width changes (sections going on and off).
Actual Flow shows the GPA being applied based on the Speed and the Machine Width.
Flow is the GPM measured by the flowmeter.
Flow Freq shows the number of pulses per second (hz) being received from the flowmeter. This should be fairly stable (± 2). When diagnosing flowmeter issues, watch this number during a tap test to see if the signal gets from the flowmeter harness connector to the display.
RPM shows the pump RPM on a hydraulic pump equipped with an RPM sensor. This should be less than 500. Can be set at 550 if maximum pump output is required. **RPM Freq** shows the signals received from the RPM sensor. This can also be used during a tap test on the Pump RPM harness connector.
Watch these values regularly during operation so you know what “normal” looks like. For example, a plugged strainer could mean the pump has to run faster than normal to get enough product. This will show up in an increased Duty Cycle and RPM.
Working Width will change as sections turn on and off. It should show the application width at any time.

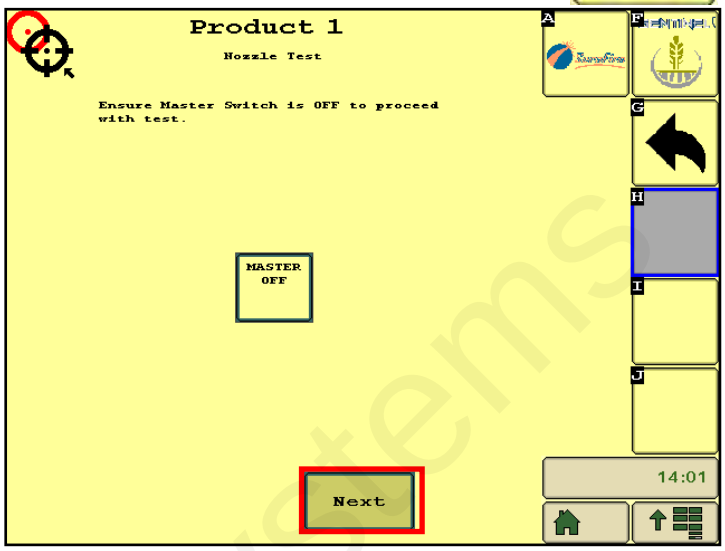
TESTS - Nozzle Test (v 1.3.0 and later)

Test run the system with a simulated speed and target rate.

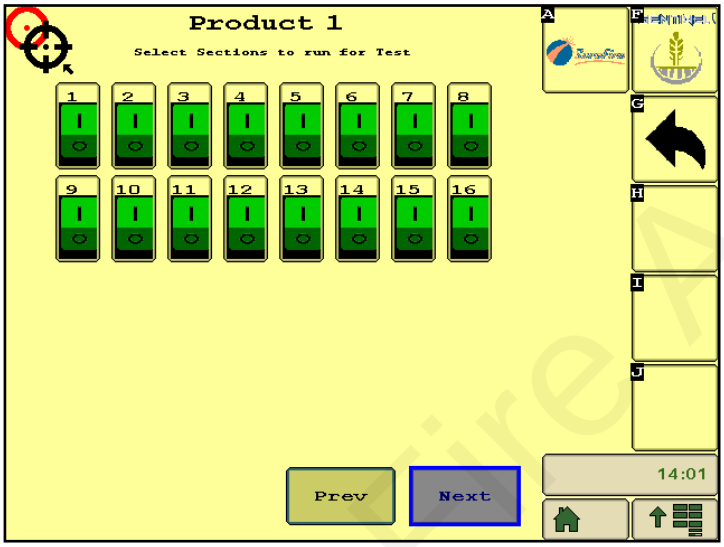
From the Product Setup page press the Nozzle Test icon.



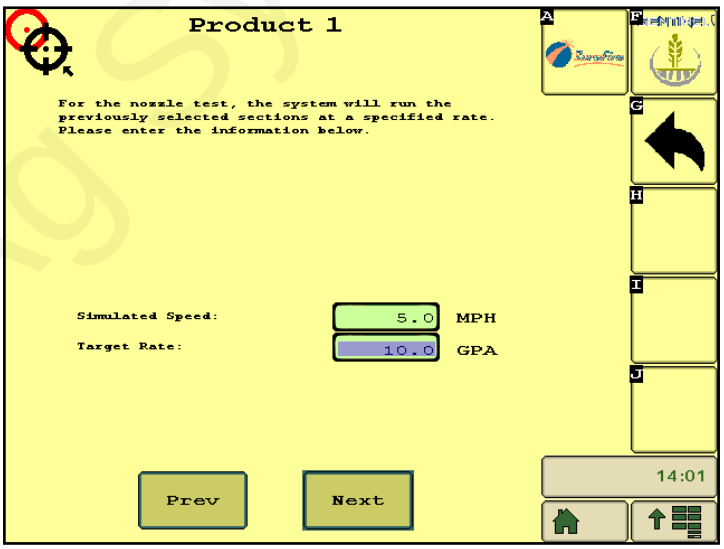
Be sure MASTER is OFF. Press NEXT.



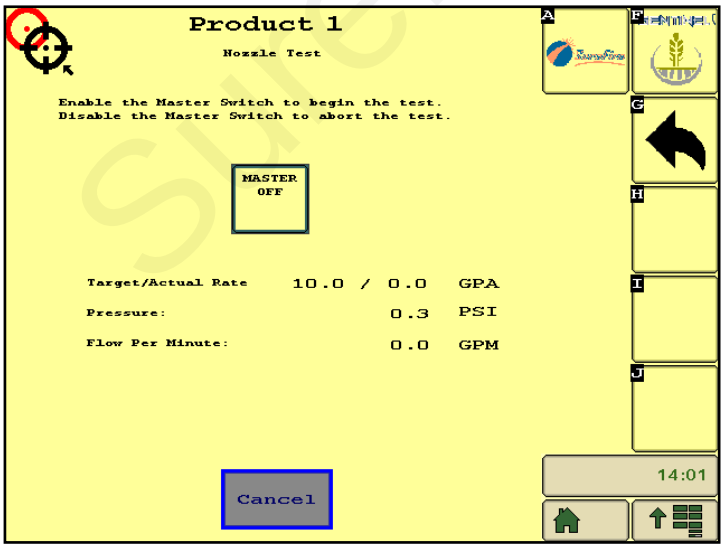
Select which sections you want to run for this test. NEXT.



Enter SPEED and RATE. NEXT.



Turn MASTER ON to start the test. Monitor Actual Rate, Pressure, and Flow per Minute.



To stop the test, turn MASTER OFF.

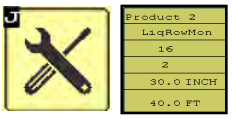
If only 1 or 2 rows are on, the system may struggle to maintain a smooth output and rate.

When testing with water, the pressure will be much less than it will be with a heavier, thicker fertilizer. On a system with check valves, some of the check valves may not open at low pressure.

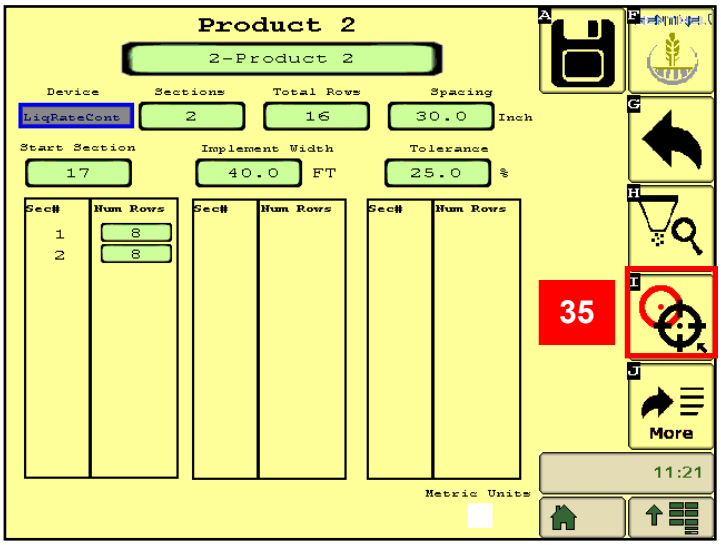
Increase the speed or rate to increase the pressure.

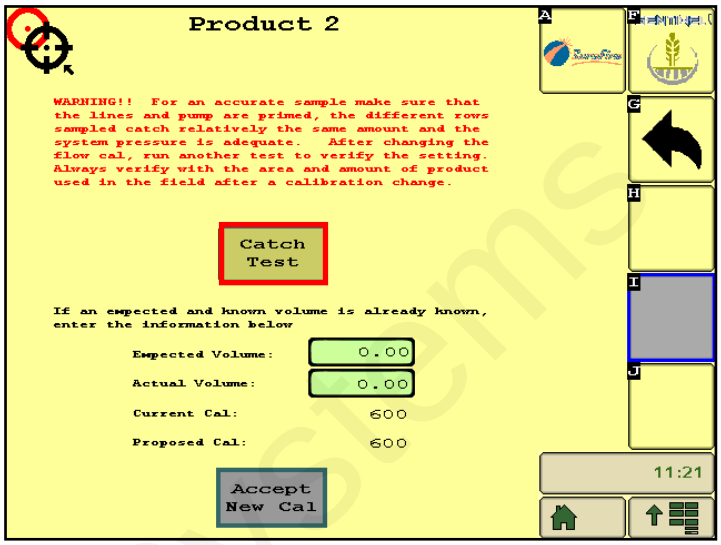
TESTS - Catch Test (v 1.3.0 and later)

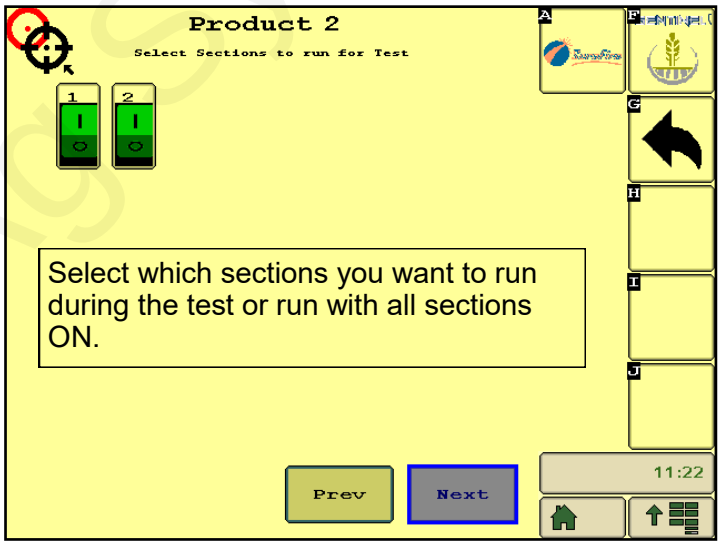
Verify and adjust the flowmeter calibration.

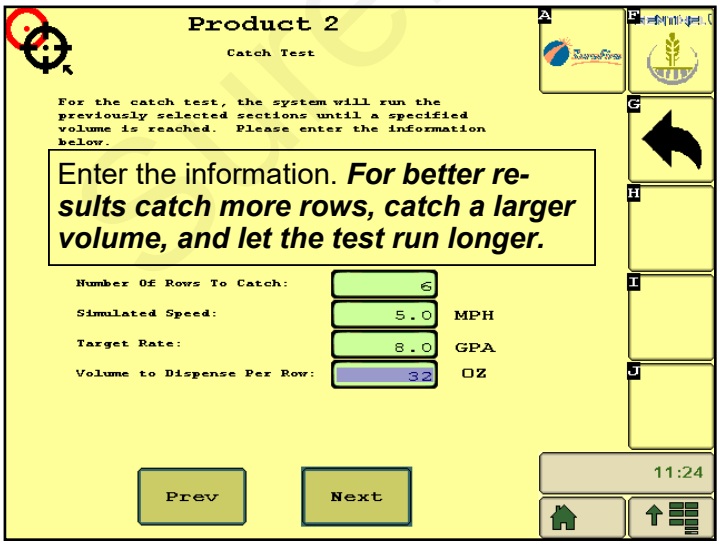


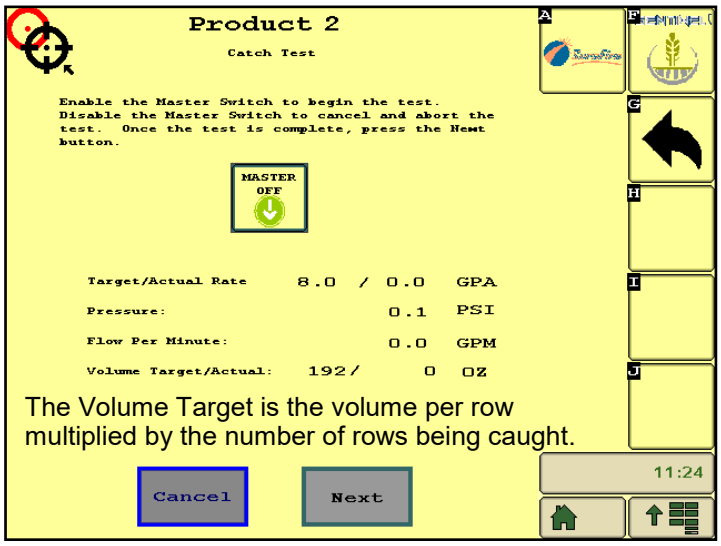
From the Product Setup page press the Catch Test icon (35). Be sure MASTER is OFF. Press CATCH TEST.











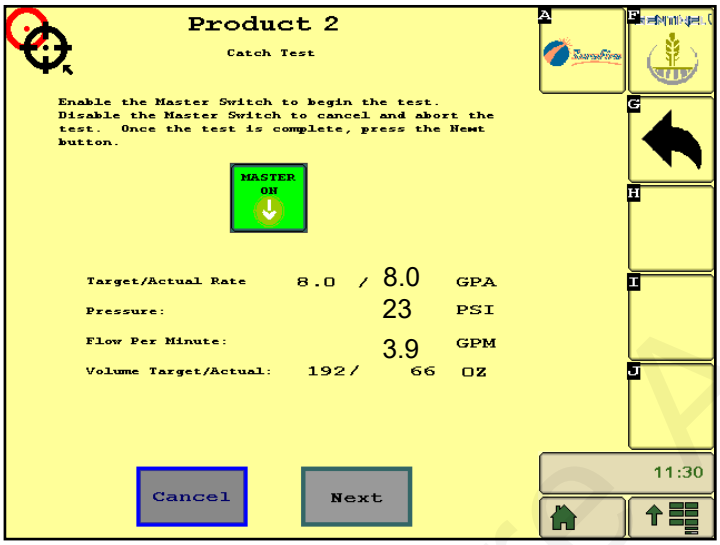
TESTS - Catch Test (v 1.3.0 and later)
Verify and adjust the flowmeter calibration.

While the test is running, the actual rate, pressure, and GPM will be shown. The Volume Target is the volume per row multiplied by the number of rows being caught. When the Volume Target for the test rows is reached, the test will stop. Pour together or add together the amount caught in all the rows tested. Enter this amount in **Actual Volume (1)**.

Repeat the catch test to verify consistency and accuracy. Note: catch tests with water, especially if the system is operating at a low pressure, may not give an accurate catch test.

SureFire electromagnetic flowmeters are typically very accurate out of the box with the factory flow cal. With accurate tests and measurements it is possible to calibrate them to 1 to 2% accuracy. A short test on a few rows with a small sample caught may not be accurate enough to adjust the flow cal. Always verify the flow cal in the field by comparing acres worked and gallons applied.

Best practices dictate ongoing verification of acres worked and gallons applied to verify flow cal.

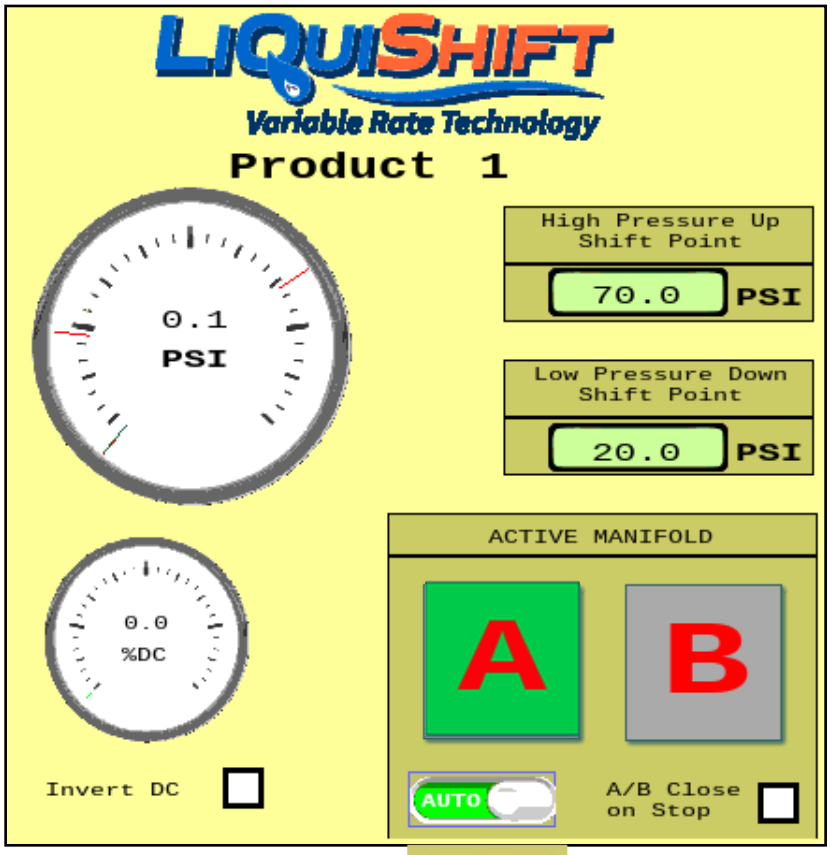


Sentinel and SureFire LiquiShift

If your system includes SureFire's LiquiShift variable rate technology, it can be controlled through the Sentinel ECU provided that the 8-pin harness extension (206-08-XXXX) is installed and plugged into the LiquiShift product connector on the main Sentinel adapter harness. To activate LiquiShift, follow these buttons:

The LiquiShift button will now be displayed on the HOME screen

Using Sentinel to control your LiquiShift eliminates the need for the LiquiShift Controller module (218-2565Y1). This is a black module that would be on the back side of the A-B LiquiShift valves. If this module is not there, an 8-pin harness extension (206-08-XXXX) is added from the Sentinel ECU harness to the LiquiShift. The Sentinel gives the operator absolute control over the LiquiShift's shift points, real-time pressure readings, and provides in-cab manual control. For more information regarding the use of Sentinel in controlling your SureFire LiquiShift, refer to your LiquiShift system manual.



Switch to MAN to control A & B valve from here

Setting LiquiShift shift points

Standard High Pressure Up Shift Point: 70 PSI

Standard Low Pressure Down Shift Point: 20 PSI

If these shift points are not set correctly, the LiquiShift may not work or may work very erratically.
They must be set so that when the valves switch, there is appropriate pressure in the new tube to keep the system operating smoothly.

For example, if the shift points are set at 50 PSI and 25 PSI, the valves will switch from A to B when the pressure in tube A reaches 50 PSI. This flow in tube B may only build 15 PSI, so it will immediately switch back to A. Since the pressure there is 50 PSI or more, it will switch to B. The system will switch back and forth repeatedly causing wild pressure rate and pressure fluctuations.

There may be situations where it may work better to use something other than a 70/20 PSI setpoint, but don't set other numbers without knowing what you are doing.

For typical operation, this box is NOT checked.

Green - Valve is ON.

Sentinel Troubleshooting

E
Trouble-Shooting

Sentinel doesn't show up on my display

1. Verify that the Sentinel ECU has power - 2 green lights should be illuminated on the ECU.
    A. Using a voltage tester, check voltage on the ECU harness.
2. Check connections:
    A. Tractor ISO plug
    B. CAN and power connections leading to the ECU harness
3. Reboot everything.

Sentinel flow module(s) will not address

1. Make sure that the trunk lines are plugged into the correct port on the module.
2. Be sure the tractor is running. Low voltage may cause modules to not address.
3. Make sure that you have all the modules plugged in before touching **RESET ALL ADDRESSES**
4. Unplug ALL modules for that Product and plug the modules in one at a time, making sure the previous module addresses before moving on to the next.
5. Verify that the lights on the module are flashing. If there are no lights, there is no power to the module.
    A. If the module lights do not light up, check the connection to the module and inspect all connections to the ECU harness.
    B. If all connections look good, use a voltmeter to check voltage to the module using the harness drawings.
    C. If 12 volts is present and module fails to light up, the module may be faulty.
6. Reboot everything.

When addressing modules, one or more modules flash green or stay blue

1. Make sure that the implement is set up with the correct number of rows.
    A. If a module is plugged in that the Sentinel is not expecting, it may flash blue/green to signify that it is addressed, but not expected. Not all ISO displays will respond this way.
2. If your implement is configured with a number of rows not divisible by 4, the last module will not show as "expected". For instance, in the case of a 6-row potato planter, 2 modules are used but only 2 rows are plumbed on the second module. When addressing, module 2 will display as "not expected." When plugged in, it will be issued an address and 6 rows will display on the Sentinel HOME screen. The last 2 rows on the module will be ignored.

Sentinel shows no flow and rows are grey

1. Make sure the **MASTER** button on the Sentinel **HOME** screen displays **MASTER ON**. If not, touch the button to cycle it.
2. Is Sentinel disabling the rows?

A. Go to the **HARDWARE** page. If **USE LIFT SWITCH** box is checked, and a dedicated lift switch is not installed, the Sentinel is disabling flow on all rows because it thinks the implement is up. Uncheck the **USE LIFT SWITCH** box. If a dedicated lift switch is installed and plugged into the Sentinel ECU harness, the switch may need adjusted to correctly show the implement status. If a lift switch is used that is normally closed, the INVERT LIFT SWITCH box needs to be checked.

3. Are you performing a stationary flow test? If so, a simulated speed must be entered and Section Control must be MAN.
4. Is a speed being displayed on the Sentinel **HOME** screen when moving?
    A. If not, change the speed source.

Sentinel Row Flow Troubleshooting

E
Trouble-Shooting

Individual rows read high or low

1. Are you testing with water? Unless the system is designed for water, row-flow will be uneven. Some rows may not flow if there is not enough pressure.
    A. Increase rate to build a minimum of 15 pounds of system pressure
2. Check row plumbing
    A. Look for pinched or kinked lines to the row
    B. Inspect check valves for plugging or damage
    C. Clean out orifices and inspect placement (seed firmer, stainless tube, etc.) for plugging
    D. Flip the outlet plumbing for 2 rows and determine if the problem follows the row
        1. If the low/high flow reading stays with the same row on the Sentinel, inspect the module for plugging.
        2. Flush the module with warm water
3. Row-flow may be too low for Sentinel to read or product may not be conductive
    A. Increase rate or add a small amount of fertilizer to product to increase conductivity
4. Perform a catch test on several rows to determine if the information being displayed is correct.
5. If the row continues to read high/low, the flow module may be faulty.

NOTE: Water is not always a great conductor. If you are having problems reading flow with water, try adding a small amount of fertilizer to your product tank.

Sentinel alarms too often

Often times during initial start-up the Sentinel alarms can seem excessive as Sentinel highlights the row-to-row inaccuracies in the system. Small things like tubing lengths and check valve springs can make big differences in row-flow. To start out, a user may consider increasing the **TOLERANCE** up to 50% until these issues are resolved. Here are some other adjustments that can be made:

1. Decrease the length of time that full-page alarms display by changing the **AUTO HIDE ALARMS** setting.
2. Increase the time before a row alarms by increasing the **ALARM TIME** setting.
3. Is Sentinel alarming when the implement is up or when turning around?
    A. Use the **IntelliSection** option
    B. Consider disabling alarms with the use of a lift switch
4. Go to the **ROW DETAILS** and disable the problematic row
5. Disable all alarms by checking the **DISABLE ALARMS** box

As-applied rate doesn't match my rate controller

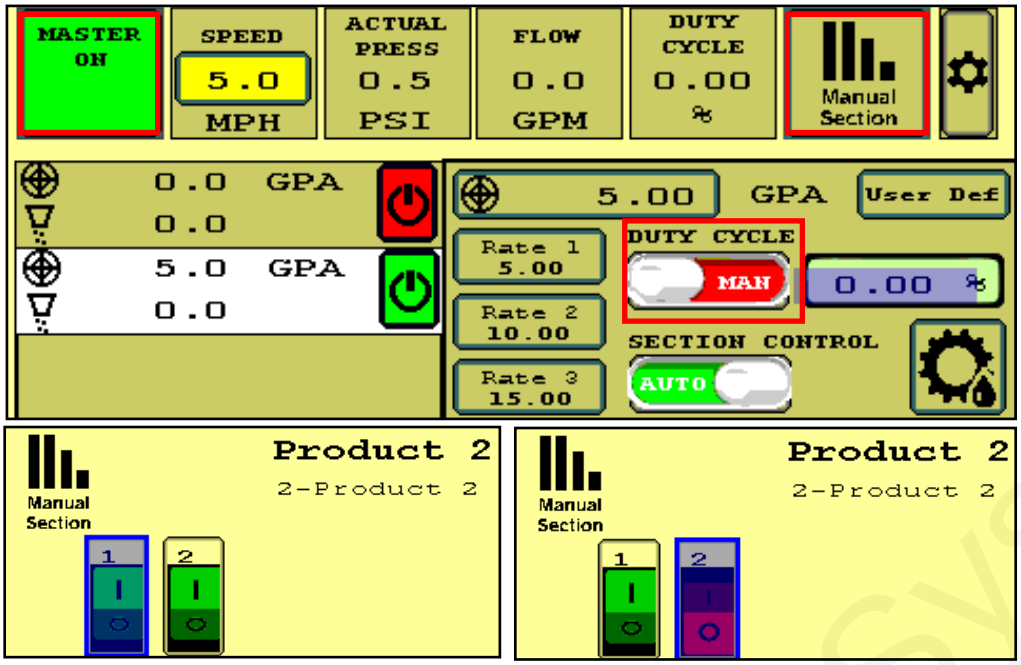
1. Do you have a small implement?
    A. If your implement has few rows, **AUTO RATE** may not calculate correctly. Try using **MANUAL RATE**
2. Use the FLOW ADJUSTMENT input box to adjust the as-applied rate.
    NOTE: Don't calibrate the Sentinel to a system that hasn't been calibrated first. Always verify flow by preforming a catch test.

Sentinel Doesn't display speed

1. Change the speed source. Toggle through the speed sources until speed displays.
2. If none of the speed sources are working, a communication problem with the tractor may exist. Consult your tractor dealer or add a GPS speed receiver found in the Accessories section of this manual.

Sentinel Rate Control Troubleshooting

Section Test or Manual Section Valve Operation and Manual Pump Operation

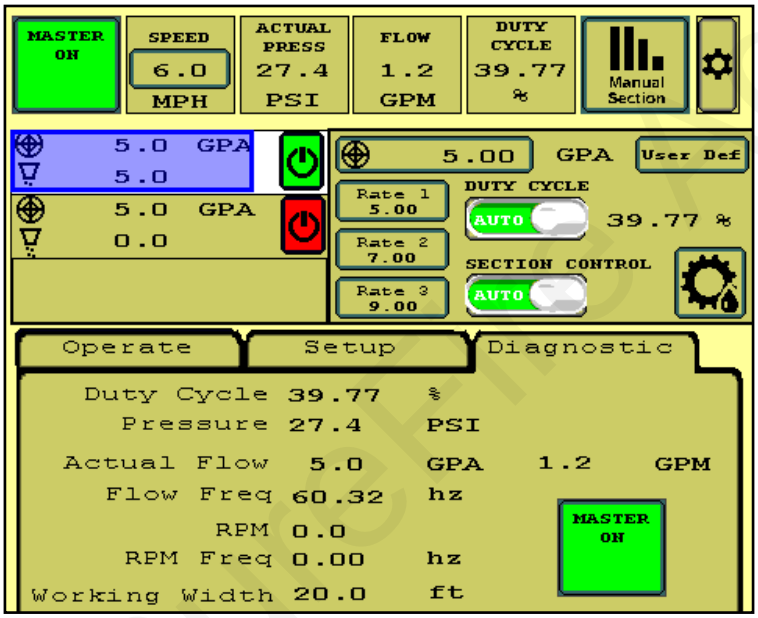


To operate the Section Valves manually, press **Manual Section**, then press any section button to turn the valve off/on.

To test the valves sitting still, put **DUTY CYCLE to MAN, MASTER** : ON, **SPEED** entered, **Section Control: MAN.**

To run the pump while doing this, enter a number for the Duty Cycle %. The Flow (GPM) and Pressure should be steady. Adjust DC%.

AUTO Test Operation



1. Enter a **SPEED** (tap the box and enter).
2. Select a **RATE.**
3. **Master ON.** Section Control - MAN.
4. Adjust SPEED and RATE to test range.
5. Observe Flow (GPM), Pressure, and Duty Cycle %. On hydraulic pump observe RPM.
6. When testing with water, the pressure will be much less than it will be with a heavier fertilizer. You may have to increase the rate significantly to open all the check valves so all rows will flow.
7. You can go to Manual Section (on the top row) and close some sections to see system response.
8. If Duty Cycle / Rate / Flow oscillate and won't lock in, decrease the Control Speed on the Setup Tab (adjust electric pump by 500, hydraulic by 50). Adjust Control Speed as needed for best field performance.

System Won't Run

1. Is MASTER ON? Is there a SPEED? Is there a RATE? Switch Section Control from AUTO to MANUAL.
2. On **Hardware** screen, uncheck TASK CONTROL. If you have TASK CONTROL checked on the Sentinel, Task Control must be activated and turned ON on the display software.
3. Verify settings for Master Switch and Implement Switch. If these boxes are checked, these items must be plugged into the Sentinel harnessing, not into harnessing for another control module. If using an IMPLEMENT SWITCH for Sentinel, is the orientation correct (check arrow on MASTER ON button)?
4. If there is a DC% showing, but the pump is not running, check the hydraulics or the EPD on an electric pump system. Verify there is voltage on the 2-pin PWM Connector.

Sentinel Care and Maintenance

F
Care & Maintenance

Cleaning

Under no circumstance should the Sentinel modules or ECU be cleaned with a pressure washer. While the flow modules and ECU are sealed, the intense pressure generated by pressure washers may penetrate the seals and cause irreversible damage.

Winterization

SureFire recommends flushing your system with adequate amounts of water first. Next, use RV antifreeze to winterize your system by pumping an adequate amount through all components. At the beginning of the next season, begin with water to verify the system is in working order with no leaks.

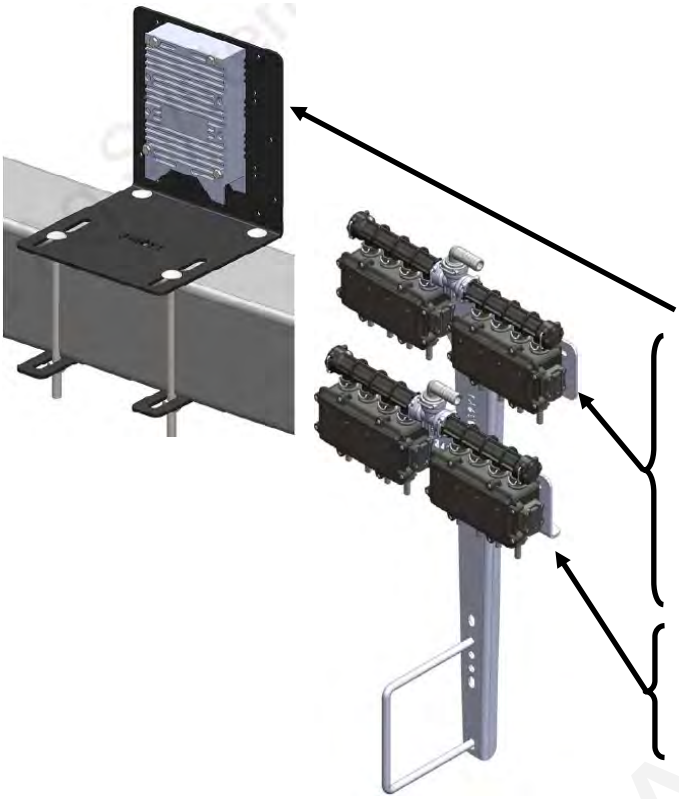
Pre-season Service

(A little time spent here may prevent some downtime when you want to be rolling.)

1. Visually check entire system (hoses, fittings, harnesses, etc.) for any signs of wear or trouble.
2. On the display, recheck all setup screens (see Section D) to verify correct setup.
3. Fill system with water and run in Manual mode to verify components and system are in working order.
4. Tighten all clamps. Loose clamps may be evident by leaks on the output side of the system. Loose clamps from the tank to the pump are not always apparent, but can be sources of air getting into the system which can create issues.
5. Push in tubes at all Quick-Connect fittings so they are seated tightly. Tubes that are not fully seated are not always obvious, but may allow air in, which can cause check valves to leak.
6. Be sure all rows are flowing and that all metering tubes/orifices are open. (Note: It will take a higher flow rate with water to create enough pressure to open all the check valves.)
7. Run a flow check (Nozzle Test) to verify that system will lock on to a Target Rate. Pressure will be much lower when testing with water than it will be with fertilizer. In some regions, tap water may not be conductive enough for the Sentinel to read accurately. Adding a small amount of fertilizer to the water will generally help.

Sentinel Accessories

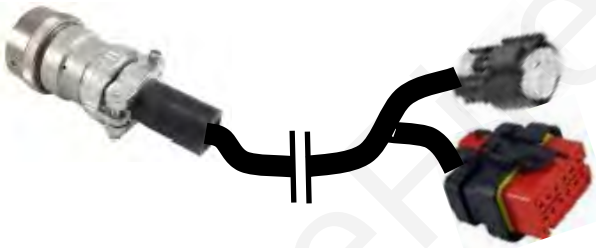
Mounting Brackets



Sentinel Mounting Brackets

Part Number	Description
515-100950	Sentinel ECU Mounting Bracket Kit
515-100201	4-Row Sentinel Mounting Bracket Kit
515-100202	8-Row Sentinel Mounting Bracket Kit
515-100203	12-Row Sentinel Mounting Bracket Kit
515-200201	4-Row **Low-Profile** Bracket Kit
515-200202	8-Row **Low-Profile** Bracket Kit
515-200203	12-Row **Low-Profile** Bracket Kit
515-100701	4-Row Dual Product Add-on Kit
515-100702	8-Row Dual Product Add-on Kit
515-100703	12-Row Dual Product Add-on Kit

ISO Extension Harnesses



Part Number	Description
214-00-3553Y1	10 FT. Front ISO Extension Harness
214-00-3554Y1	20 FT. Front ISO Extension Harness
214-00-3555Y1	30 FT. Front ISO Extension Harness
214-00-3556Y1	40 FT. Front ISO Extension Harness
214-00-3557Y1	50 FT. Front ISO Extension Harness

Implement Height Switches

Part Number	Description
501-100530	Magnetic Finger Type Height Switch
501-1005	Magnetic Mercury Switch
501-100520 / 100525	Push Button Switch for Parallel Arms

GPS Speed Receiver

Part Number	Description
203-01-01410	Astro II with 3-pin MP 150 Shroud

Notes:

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