RCM Liquid Slurry + NIR Sensor Tanker and Dragline Installation Manual

016-7100-045 Rev. B *8/23* *E41854*

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CHAPTER 1 IMPORTANT INFORMATION

SAFETY

NOTICE

Follow the operation and safety instructions included with the implement and/or controller and read this manual carefully before installing or operating this Raven system.

- Follow all safety information presented within this manual. Review implement operation with your local dealer.
- Contact a local Raven dealer for assistance with any portion of the installation, service, or operation of Raven equipment.
- Follow all safety labels affixed to system components. Be sure to keep safety labels in good condition and replace any missing or damaged labels. Contact a local Raven dealer to obtain replacements for safety labels.

Observe the following safety measures when operating the implement after installing this Raven system:

- Do not operate this Raven system or any agricultural equipment while under the influence of alcohol or an illegal substance.
- Be alert and aware of surroundings and remain in the operator seat at all times when operating this Raven system.
    - Do not operate the implement on any public road with this Raven system enabled.
    - Disable this Raven system before exiting the operator seat.
    - Determine and remain a safe working distance from obstacles and bystanders. The operator is responsible for disabling the system when a safe working distance has diminished.
    - Disable this Raven system prior to starting any maintenance work on the implement or components of this Raven system.
- Do not attempt to modify or lengthen any of the system control cables. Extension cables are available from a local Raven dealer.

DISPLAYS AND CONTROL CONSOLES

- If the display will not be used for an extended period, it is best to remove the display from the machine and store it in a climate controlled environment. This may help to extend the service life of electronic components.
- To prevent theft, secure the display and GPS antenna when leaving the machine unattended.

WARNING

AGRICULTURAL CHEMICAL SAFETY

Follow all federal, state, and local regulations regarding the handling, use, and disposal of agricultural chemicals, products, and containers. Triple-rinse and puncture or crush empty containers before properly disposing of them. Contact a local environmental agency or recycling center for additional information.

- Always follow safety labels and instructions provided by the chemical manufacturer or supplier.
- Always wear appropriate personal protective equipment as recommended by the chemical and/or equipment manufacturer.
- When storing unused agricultural chemicals:
    - Store agricultural chemicals in the original container and do not transfer chemicals to unmarked containers or containers used for food or drink.
    - Store chemicals in a secure, locked area away from human and livestock food.
    - Keep children away from chemical storage areas.
- Fill, flush, calibrate, and decontaminate chemical application systems in an area where runoff will not reach ponds, lakes, streams, livestock areas, gardens, or populated areas.
- Follow all label instructions for chemical mixing, handling, and disposal.
- Avoid direct contact with agricultural chemicals or inhaling chemical dust or spray particulate. Seek immediate medical attention if symptoms of illness occur during, or soon after, use of agricultural chemicals or products.
- After handling or applying agricultural chemicals:
    - Thoroughly wash hands and face after using agricultural chemicals and before eating, drinking, or using the restroom.
    - Thoroughly flush or rinse equipment used to mix, transfer, or apply chemicals with water after use or before servicing any component of the application system.

HYDRAULIC SAFETY

When installing or servicing a hydraulic system or hydraulic components, be aware that hydraulic fluid may be extremely hot and under high pressure. Caution must be exercised.

- Always wear appropriate personal protective equipment when installing or servicing hydraulic systems.
- Never attempt to open or work on a hydraulic system with the implement running.
- Any work performed on the hydraulic system must be done in accordance with the machine manufacturer's approved maintenance instructions.
- Care should always be taken when servicing or opening a system that has been pressurized.
- The implement or machine must remain stationary and switched off with booms or implement sections unfolded and supported during installation or maintenance.
- Take precautions to prevent foreign material or contaminants from being introduced into the implement hydraulic system. Contaminants that are able to bypass the hydraulic filtration system will reduce performance and may damage hydraulic components.
- Stand clear of the implement when starting the system for the first time after installing or servicing hydraulic components in case a hose has not been properly connected or tightened.

⚠ CAUTION

ELECTRICAL SAFETY

- Always verify that power leads are connected to the correct polarity as marked. Reversing the power leads could cause severe damage to the Raven system or other components.
- To prevent personal injury or fire, replace defective or blown fuses with only fuses of the same type and amperage.
- Do not connect the power leads to the battery until all system components are mounted and all electrical connections are completed.
- Always start the machine before initializing this Raven system to prevent power surges or peak voltage.
- To avoid tripping and entanglement hazards, route cables and harnesses away from walkways, steps, grab bars, and other areas used by the operator or service personnel when operating or servicing the equipment.

TOUCH SCREEN

- Only touch the touch-screen with your finger or by using a special touch-screen stylus/pen. Operating the touch-screen with sharp objects may cause permanent damage to the screen.
- Only clean the screen using a damp cloth. Never use caustic or other aggressive substances.

RECOMMENDATIONS AND BEST PRACTICES

AERIALS AND SIGNAL INTERFERENCE

Due to the relatively low broadcast power from satellites, all GNSS receivers and aerials tend to be susceptible to sources of signal noise and interference as compared to terrestrial signals (i.e. radio or cellular).

NOTE: Poor GNSS signal reception may cause other systems which rely on GNSS solutions (e.g. auto-steer systems, rate control systems, etc.) to disengage or may cause undesired operation or results.

The following recommendations are intended to provide an optimal environment for GNSS systems and provide the best up-time results, even as sources of interference may spike throughout the day.

- Mount GNSS antennas with a clear, unobstructed view of the sky.
    - A minimum clearance of 1 m [39 in] is recommended around the GNSS antenna to help avoid common issues with signal interference. Do not mount cellular, radio, or other GNSS antennas within this area.
    - Mount the GNSS antenna to the tallest point of the machine. Avoid mounting the antenna in a location where obstructions (e.g. bins/hoppers, cab roof lines, equipment frame or structural elements, etc.) may rise into the antenna view.

NOTE: The antenna view typically starts 5° to 10° above horizontal from the base of the antenna and extends over the skyward face of the receiver/antenna.

- GNSS is a line-of-sight system. A clear path must exist between the satellite and the GNSS antenna.
    - Obstructions such as buildings, tree branches and limbs, as well as components of the vehicle such as a fiberglass or metal roof, and etc. may cause signal multi-path or completely block the GNSS receiver.
- Electrical and magnetic fields can interfere with GNSS or L-Band signals.
    - Avoid mounting GNSS receivers or antennas near components such as radio or cellular antennas, electrical motors, generators, alternators, strobe lights, radio transmitters, radio or cellular antennas, etc.
    - Over-head power lines, microwave dishes, radar, other active antennas, etc. can interfere with GNSS signal.
- Mount the Field Hub cellular and diversity antennas at least 1 m [39 in] apart. Avoid mounting other cellular, radio, or GNSS aerials within this area.

HOSE ROUTING

The word “hose” is used to describe any flexible, fluid carrying components. Use the following guidelines and recommendations when connecting and routing hoses while installing or maintaining this Raven system:

- Leave protective caps/covers over hose ends until connecting the end into the hydraulic system to help prevent contaminants from entering the system.
- Follow existing hose runs already routed on the implement as much as possible. Proper hose routing should:
    - Secure hoses and prevent hoses from hanging below the implement.
    - Provide sufficient clearance from moving components and operational zones around shafts; universal joints and suspension components; pulleys, gears, belts, and chains; moving linkages, cylinders, articulation joints, etc.
    - Protect hoses from field debris and surrounding hazards (e.g. tree limbs, fence posts, crop stubble, dirt clumps or rocks that may fall or be thrown by the implement).

  - Protect hoses from sharp bends, twisting, or flexing over short distances and normal implement operation.
  - Ensure sufficient length for free movement of the implement during normal operation and prevent pulling, pinching, catching, or rubbing, especially in articulation and pivot points. Clamp hoses securely to force controlled movement of the hose.
  - Avoid abrasive surfaces and sharp edges such as sheared or flame cut corners, fastener threads or cap screw heads, hose clamp ends, etc.
  - Avoid areas where the operator or service personnel might step or use as a grab bar.
- Do not connect, affix, or allow hoses to come into contact with components with high vibration forces, hot surfaces, or components carrying hot fluids beyond the temperature rating of hose components.
  - Hoses should be protected or shielded if routing requires the hose to be exposed to conditions beyond hose component specifications.
- Avoid routing hoses in areas where damage may occur due to build up of material (e.g. dirt, mud, snow, ice, etc.).

HARNESS ROUTING

The word “harness” is used to describe any electrical cables and leads, both bundled and unbundled. Use the following guidelines and recommendations when connecting and routing harnesses while installing or maintaining this Raven system:

- Leave protective caps/covers over harness connectors until needed to avoid dirt and moisture from contaminating electrical circuits.
- Secure the harness to the frame or solid structural members at least every 12 in [30 cm].
- Follow existing harness runs already routed on the implement as much as possible. Proper harness routing should:
  - Secure harnessing and prevent the harness from hanging below the implement.
  - Provide sufficient clearance from moving components and operational zones around shafts; universal joints and suspension components; pulleys, gears, belts, and chains; moving linkages, cylinders, articulation joints, etc.
  - Protect harnessing from field debris and surrounding hazards (e.g. tree limbs, fence posts, crop stubble, dirt clumps or rocks that may fall or be thrown by the implement).
  - Protect harnessing from sharp bends, twisting, or flexing over short distances and normal implement operation.
  - Connectors and splices should not be located at bending points or in harness sections that move.
  - Ensure sufficient length for free movement of the implement during normal operation and prevent pulling, pinching, catching, or rubbing, especially in articulation and pivot points. Clamp harnessing securely to force controlled movement of the harness.
  - Avoid abrasive surfaces and sharp edges such as sheared or flame cut corners, fastener threads or cap screw heads, hose clamp ends, etc.
- Do not connect, affix, or allow harnessing to come into contact with components with high vibration forces, hot surfaces, or components carrying hot fluids beyond the temperature rating of harness components.
  - Harnessing should be protected or shielded if routing requires the hose to be exposed to conditions beyond harnessing component specifications.
- Avoid routing harnesses in areas where damage may occur due to build up of material (e.g. dirt, mud, snow, ice, etc.).
- Avoid routing harnesses in areas where the operator or service personnel might step or use as a grab bar.

IMPORTANT: Avoid applying direct spray or pressure washing of electrical components and connections. High pressure streams and sprays can penetrate seals, cause corrosion, or otherwise damage electrical components. When performing maintenance:

- Inspect electrical components and connectors for corrosion, damaged pins or housings, etc. Repair or replace components or harnessing as necessary.
- Ensure connectors are kept clean and dry. Apply dielectric grease to the sealing surfaces of all connections exposed to moisture, dirt, debris, and other contaminates. Repair or replace harnessing as necessary.
- Clean electrical components with pressurized air, aerosol electrical cleaning agent, or low pressure rinse.
- Remove visible surface water from electrical components and connections using pressurized air or an aerosol cleaning agent. Allow components to dry thoroughly before reconnecting cables.

CHAPTER 2 INTRODUCTION

The Raven Rate Control Module (RCM) is a multi-product application control system built on an ISOBUS platform. The Raven Rate Control Module is designed to provide a machine operator the ability to simultaneously monitor and control five product applications such as liquid, granular, NH3, direct injection, and liquid slurry via ISOBUS Universal Terminal (UT) and task control for as-applied documentation, prescription rate, and section control.

The Raven Rate Control Module plus the CNHi Dinamica Generale near infrared sensor (NIR sensor) provides a multi-product application control system for liquid slurry applications on both tanker and dragline platforms. The system builds off the Raven RCM five product capabilities to provide a machine operator the ability to simultaneously monitor four nutrients in addition to slurry flow rate. The operator can select either PR1 or one of the four nutrients, nitrogen, ammonium, phosphorus, potassium (NAPK) to control the rate of at a time. The remaining nutrients are logged for as applied documentation.

MAKE AND MODEL COMPATIBILITY

The Raven RCM and NIR Sensor can be mounted and integrated onto most slurry tankers and dragline systems.

For slurry tankers, the tanker must have a flow meter, control valve, and pressure transducer. It can have additional pressure sensors and section control valves.

For dragline system, the system must have a flow meter. In dragline operation the RCM will provide a recommended speed to achieve the desired application.

The Raven RCM and NIR Sensor are compatible with any ISOBUS compatible task controller. CNHi and Raven task controllers operate in the Advance ISOBUS NPK mode while other task controllers operate in the Generic ISOBUS Compatibility mode.

INSTALLATION OVERVIEW

The recommended process for installing the RCM + NIR Sensor liquid slurry system is as follows:

1. Confirm kit contents for Raven provided kits. See “Kit Contents” on page 8.
2. Confirm all required non-Raven components.
3. Identify where to install the NIR Sensor.
4. Prepare the pipe location for the NIR Sensor mounting pipe weldment or mounting bracket.
5. Install the NIR Sensor.
6. Identify a mounting location for the Raven RCM and NIR Sensor ECU.
7. Prepare the mounting location.
8. Mount the Raven RCM and NIR Sensor ECU.

9. Route the cabling from the Raven RCM to the NIR Sensor and NIR Sensor ECU.
10. Route the cabling from the Raven RCM to the task controller, flow meter, and other optional components.
11. Secure all cabling.
12. Review calibration and setup guide notes.

KIT CONTENTS

This section contains a list of the components that are included in the RCM Liquid Slurry + NIR Sensor kit. Before beginning the RCM Liquid Slurry + NIR Sensor installation, compare the items in the kit with the components on this list. If you have questions about the kit, contact your Raven dealer.

FIGURE 1. Raven RCM, Liquid Slurry Tanker and Dragline Kit (P/N 117-7100-010 Rev. C)

QTY	PART #	DESCRIPTION
1	053-0159-193	BOX, SHIPPING
1	016-0171-649	QSG RAVEN HELP
1	063-0173-941B	RAVEN RATE CONTROL MODULE, LEVEL 1
1	117-0171-648	KIT, MAGNET MOUNT, RCM
1	412-2011-113	SWITCH FOOT SPDT MAINTAINED
1	115-0172-398	CBL FOOT SWITCH 23' 4WD TRACTOR
1	115-7100-008	CABLE ADAPTER 17' 9PIN IBIC 3PIN MASTER
1	115-7100-052	CBL RCM LIQUID SLURRY GEN 1, 3 PIN DT MAGMETER

FIGURE 2. CNHi RCM, Liquid Slurry Tanker and Dragline Kit (P/N 117-7100-058 Rev. A)

QTY	PART #	DESCRIPTION
1	053-0159-193	BOX, SHIPPING
1	016-0171-649	QSG RAVEN HELP
1	063-0174-131	CNHI RATE CONTROL MODULE, LEVEL 1
1	117-0171-648	KIT, MAGNET MOUNT, RCM
1	412-2011-113	SWITCH FOOT SPDT MAINTAINED
1	115-0172-398	CBL FOOT SWITCH 23' 4WD TRACTOR
1	115-7100-008	CABLE ADAPTER 17' 9PIN IBIC 3PIN MASTER
1	115-7100-052	CBL RCM LIQUID SLURRY GEN 1, 3 PIN DT MAGMETER

FIGURE 3. Liquid Slurry, NIR Sensor, Mounting, 6” Pipe Kit (P/N 117-7100-056 Rev. C)

QTY	PART #	DESCRIPTION
1	053-0159-108	BOX, SHIPPING
1	116-0159-873	WELDMENT, NIR SENSOR, COVER
1	107-0172-766	BRACKET, NIR SENSOR, COVER LID
1	107-0172-774	PLATE, NIR SENSOR, COVER PLATE
1	116-0159-874	WELDMENT, NIR SENSOR, 6" PIPE MOUNT
4	107-0172-768	PLATE, NIR SENSOR, 6" PIPE MOUNT, 8-HOLE FLANGE
4	107-0172-769	PLATE, NIR SENSOR, 6" PIPE MOUNT, 4-HOLE FLANGE
4	107-0172-770	PLATE, NIR SENSOR, 6" PIPE MOUNT, 4-HOLE CROSS PLATE
1	115-7100-068	CABLE, LIQUID SLURRY, NIR SENSOR, GEN 1 ISO
1	077-0180-332	ACTIVATION CODE, RCM, LIQUID SLURRY, NIR SENSOR
1	053-0159-110	ENVELOPE, PLASTIC
4	311-4051-230N	HEX BOLT, M10X1.5, 60MM, ISO4014, 10.9 STEEL, CLASS V
2	311-4051-223N	HEX BOLT, M10X1.5, 25MM, ISO4014, 10.9 STEEL, CLASS V
12	313-6000-016N	WASHER, M10, DIN125, CARBON STEEL, CLASS V
6	312-6001-043N	HEX NUT, M10X1.5, DIN985, 10.9 STEEL, CLASS V
1	053-0159-110	ENVELOPE, PLASTIC
8	311-4051-318N	HEX BOLT, M14X2.0, 70MM, ISO4014, 10.9 STEEL, CLASS V
16	313-6000-022N	WASHER, M14, DIN125, CARBON STEEL, CLASS V
8	312-6001-068N	HEX NUT, M14X2.0, DIN985, 10.9 STEEL, CLASS V
1	053-0159-110	ENVELOPE, PLASTIC
16	311-4051-402N	HEX BOLT, M18X2.5, 60MM, ISO4014, 10.9 STEEL, CLASS V
32	313-6000-028N	WASHER, M18, DIN125, CARBON STEEL, CLASS V
16	312-6001-093N	HEX NUT, M18X2.5, DIN985, 10.9 STEEL, CLASS V
1	053-0159-015	ENVELOPE, PLASTIC
1	016-7100-045	MANUAL, INSTALL, RCM+NIR SENSOR TANKER & DRAGLINE

FIGURE 4. Liquid Slurry, NIR Sensor, Universal, Field Mounting Install Kit (P/N 117-7100-057 Rev. C)

QTY	PART #	DESCRIPTION
1	053-0159-072	BOX, SHIPPING
1	116-0159-873	WELDMENT, NIR SENSOR, COVER
1	107-0172-766	BRACKET, NIR SENSOR, COVER LID
1	107-0172-774	PLATE, NIR SENSOR, COVER PLATE
1	107-0172-846	PLATE, NIR SENSOR, MOUNTING
1	115-7100-068	CABLE, LIQUID SLURRY, NIR SENSOR, GEN 1 ISO
1	077-0180-332	ACTIVATION CODE, RCM, LIQUID SLURRY, NIR SENSOR
1	053-0159-110	ENVELOPE, PLASTIC
4	311-4051-230N	HEX BOLT, M10X1.5, 60MM, ISO4014, 10.9 STEEL, CLASS V
2	311-4051-223N	HEX BOLT, M10X1.5, 25MM, ISO4014, 10.9 STEEL, CLASS V
12	313-6000-016N	WASHER, M10, DIN125, CARBON STEEL, CLASS V
6	312-6001-043N	HEX NUT, M10X1.5, DIN985, 10.9 STEEL, CLASS V
1	053-0159-015	ENVELOPE, PLASTIC
1	016-7100-045	MANUAL, INSTALL, RCM+NIR SENSOR TANKER& DRAGLINE
1	016-7100-056	SHEET, FIELD INSTALLATION, NIR SENSOR MOUNTING CUTOU

UPDATES

Updates for Raven manuals as well as software updates for Raven consoles, and product controllers are available at the Applied Technology Division web site:

https://portal.ravenprecision.com

The Raven Service Tool and a laptop PC are required to perform software updates of the Raven Rate Control Module. Refer to the Raven Service Tool Operation manual for additional assistance with updating the Raven Rate Control Module.

Sign up for e-mail alerts to receive notifications when updates for your Raven products are available on the Raven web site.

At Raven Industries, we strive to make your experience with our products as rewarding as possible. One way to improve this experience is to provide us with feedback on this manual.

Your feedback will help shape the future of our product documentation and the overall service we provide. We appreciate the opportunity to see ourselves as our customers see us and are eager to gather ideas on how we have been helping or how we can do better.

To serve you best, please send an email with the following information to

techwriting@ravenind.com

-RCM Liquid Slurry + NIR Sensor Tanker and Dragline Installation Manual
-016-7100-045 Rev. B
-Any comments or feedback (include chapter or page numbers if applicable).
-Let us know how long have you been using this or other Raven products.

We will not share your email or any information you provide with anyone else. Your feedback is valued and extremely important to us.

Thank you for your time.

CHAPTER 3 NIR SENSOR INSTALLATION

PREPARE FOR THE INSTALLATION

Perform the following procedure to prepare the implement for the installation of the Raven RCM and NIR Sensor liquid slurry system:

1. Clean the outside of the implement.
2. Drain and rinse the tank and pipes of the implement.
3. Disable any application control system currently installed on the implement if present.
4. Turn off the tractor and implement, disconnect the battery so no power is present during installation.

INSTALL THE NIR SENSOR WITH PIPE MOUNT

MOUNT THE NIR SENSOR

1. Locate the NIR Sensor, the pipe mount weldment (P/N 116-0159-874 for 15.24 cm [6 in] pipe or P/N 116-0159-875 for 20.32 cm [8 in] pipe), and the sensor cover (P/N 116-0159-873).
2. Remove the M6 bolts from the NIR Sensor securing the mounting brackets.
3. Slide the cover over the NIR Sensor and mounting brackets and secure using the M6 bolts.

NOTE: Orient the cover with the open end allowing the sensor connectors to be accessible.

4. Mount the NIR Sensor to the pipe mount weldment with the provided M10 hardware.

NOTE: Use both of the provided foam gaskets to seal the NIR Sensor to the pipe. The smaller foam gasket seals the lens of the sensor to the pipe. The larger foam gasket seals the environment from the lens.

INSTALL THE NIR SENSOR ON TANKER

1. Locate a straight section of supply piping that is at least 350 mm [13.78 in] long.

NOTE: This section should be completely vertical or completely horizontal for the best results.

If a Magmeter flow meter is present it is preferred to install the NIR Sensor immediately following it.

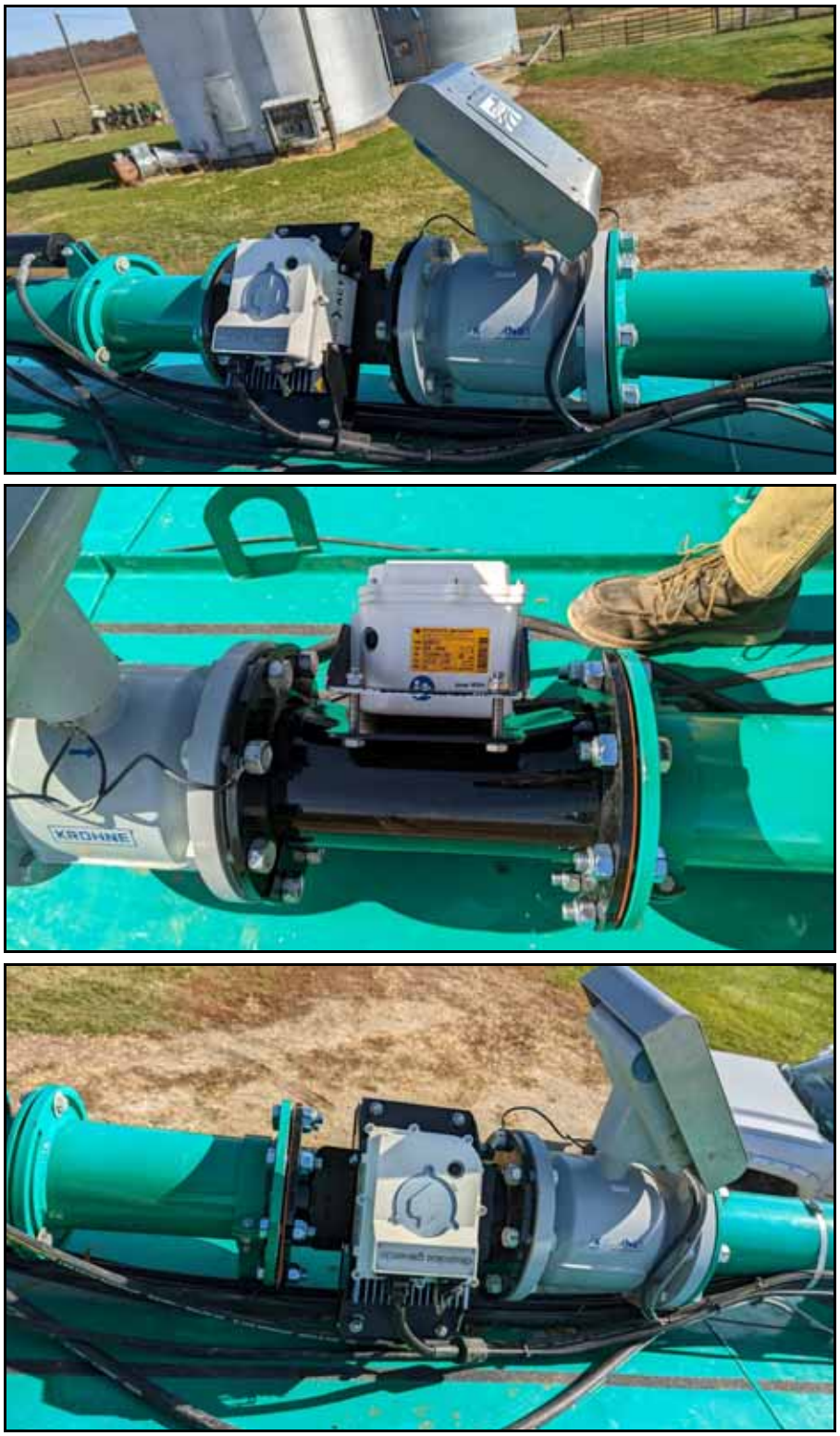
If existing flanges are present along the pipe use the flange as the start or end point of the install.

2. Remove the appropriate section of pipe to fit the NIR Sensor pipe mounting weldment (P/N 116-0159-874 for 15.24 cm [6 in] pipe or P/N 116-0159-875 for 20.32 cm [8 in] pipe). This can be done be removing a flanged section of pipe or cutting out a solid section of pipe.
3. Weld on flanges to the existing pipe for the pipe mounting weldment to mate to.

4. Mount the weldment with the sensor installed to the new flanges using the provided split flanges.

NOTE: If installing on a section of horizontal pipe, mount the weldment so the opening is on the side of the pipe. Do not place it underneath to prevent debris from covering the reading glass. Do not place it on top of the pipe to avoid incorrect readings due to air bubbles.

FIGURE 1. NIR Sensor Installed on Tanker



INSTALL THE NIR SENSOR ON DRAGLINE

1. Locate a section of piping that is at least 350 mm [13.78 in] long or is capable of 350 mm of pipe being added.

NOTE: This section should be completely vertical or completely horizontal for the best results.

If a Magmeter flow meter is present it is preferred to install the NIR Sensor immediately following it.

If existing flanges are present along the pipe use the flange as the start or end point of the install.

2. Remove the appropriate section of pipe to fit the NIR Sensor pipe mounting weldment (P/N 116-0159-874 for 15.24 cm [6 in] pipe or P/N 116-0159-875 for 20.32 cm [8 in] pipe). This can be done be removing a flanged section of pipe or cutting out a solid section of pipe.
3. Or add on additional pipe to allow the mounting weldment to fit on the dragline.
4. Weld on flanges to the existing pipe for the pipe mounting weldment to mate to.
5. Mount the weldment with the sensor installed to the new flanges using the provided split flanges.

NOTE: If installing on a section of horizontal pipe, mount the weldment so the opening is on the side of the pipe. Do not place it underneath to prevent debris from covering the reading glass. Do not place it on top of the pipe to avoid incorrect readings due to air bubbles.

FIGURE 2. NIR Sensor Installed on Dragline

INSTALL THE NIR SENSOR WITH UNIVERSAL MOUNT

INSTALL NIR SENSOR MOUNTING BRACKET

1. Locate a straight section of supply piping that is at least 350 mm [13.78 in] long.

NOTE: This section should be completely vertical or completely horizontal for the best results. If a Magmeter flow meter is present, it is preferred to install the NIR sensor immediately following it.

2. Using the NIR Sensor mounting bracket cutout (P/N 016-7100-056), mark the hole to cutout of the section of pipe.

NOTE: Mark the hole cutout on the side of the pipe for the best results. Air at the top of the pipe causes inaccurate readings.

3. Cut the hole out of the pipe and remove sharp edges from the cutout profile.
4. Locate the NIR sensor mounting bracket (P/N 107-0172-859).
5. Position and align the mounting bracket onto the cutout hole. Orient the bracket with the bent ends parallel with the pipe fitting into the cutout and the large hole of the bracket centered on the cutout hole.

NOTE: The bent edges should sit flush with the outside of the pipe where the cutout ends.

6. Weld the mounting bracket to the pipe fully sealing the edge between the bracket and pipe.

MOUNT THE NIR SENSOR

1. Locate the NIR sensor, the two provided foam gaskets, the sensor cover (P/N 116-0159-873), and the sensor cover lid (P/N 107-0172-766).
2. Remove the M6 bolts from the NIR sensor securing the mounting brackets.
3. Slide the cover over the NIR sensor and mounting brackets and secure reusing the M6 bolts.

NOTE: Orient the cover with the open end allowing the sensor connectors to be accessible.

4. Install the provided foam gaskets on the center lens of the NIR sensor. The smaller foam gasket seals the lens of the sensor to the pipe/bracket. The larger foam gasket seals the environment from the lens.
5. Mount the NIR sensor to the installed mounting bracket with the provided M10 hardware.
6. Use the shorter M10 bolts to install the cover lid to the cover.

SYSTEM DRAWINGS

NOTE: System drawings begin on the next page.

FIGURE 3. Raven Rate Control Module Liquid Slurry System Drawing Pg. 1 (P/N 054-7100-056 Rev. C)

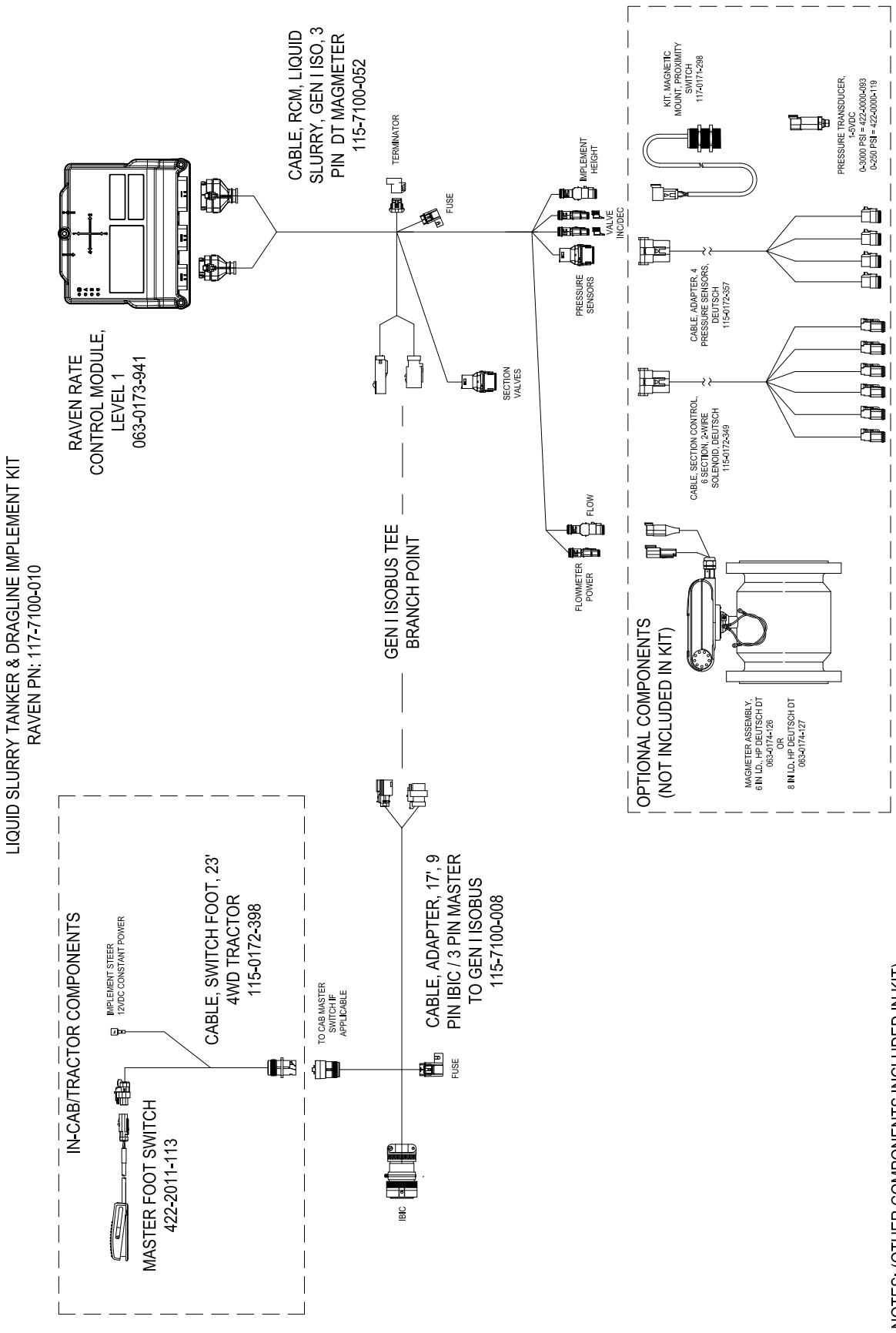


FIGURE 4. Raven Rate Control Module Liquid Slurry System Drawing Pg. 2 (P/N 054-7100-056 Rev. C)

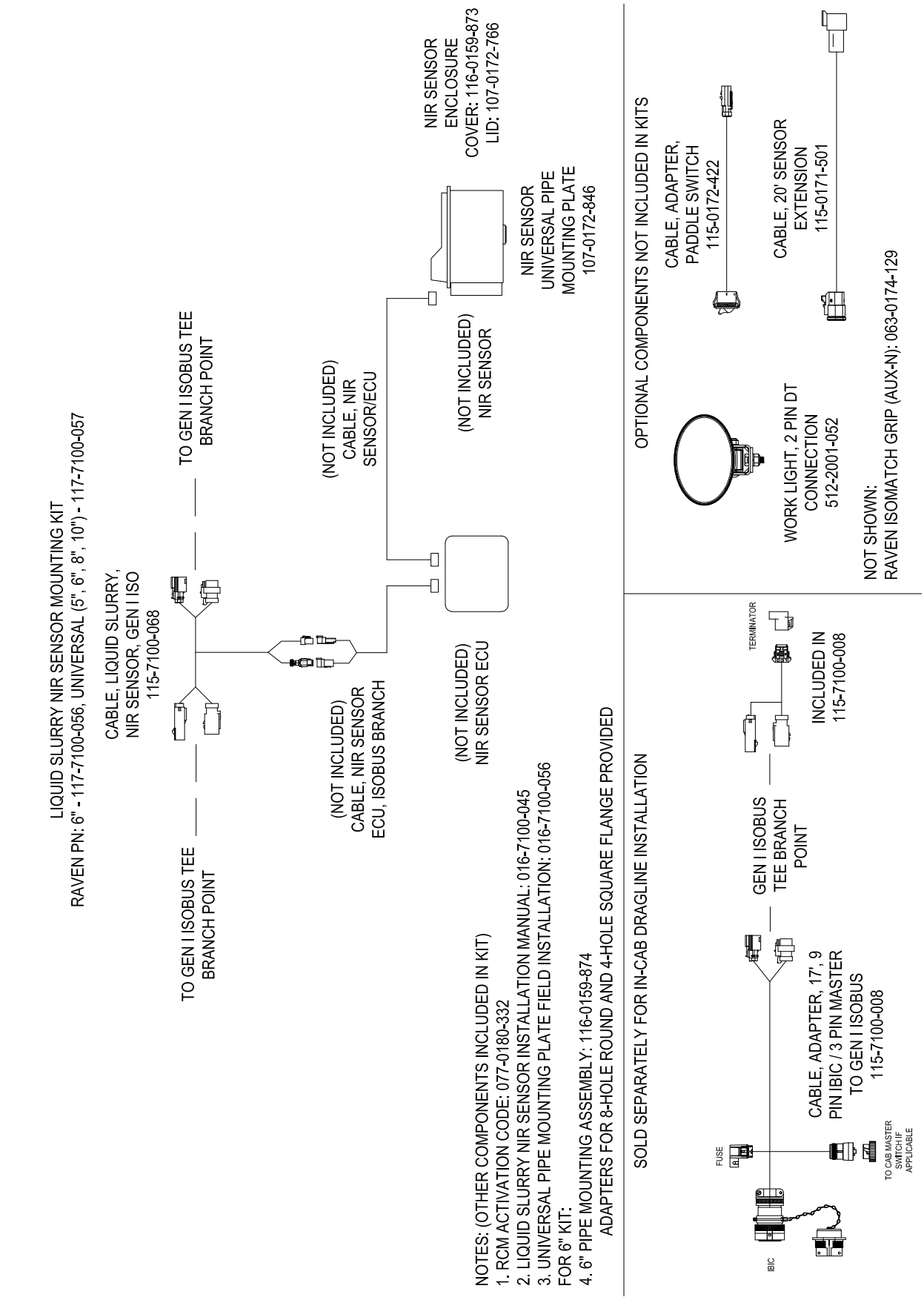


FIGURE 5. CNHi Rate Control Module Liquid Slurry System Drawing Pg. 1 (P/N 054-7100-057 Rev. C)

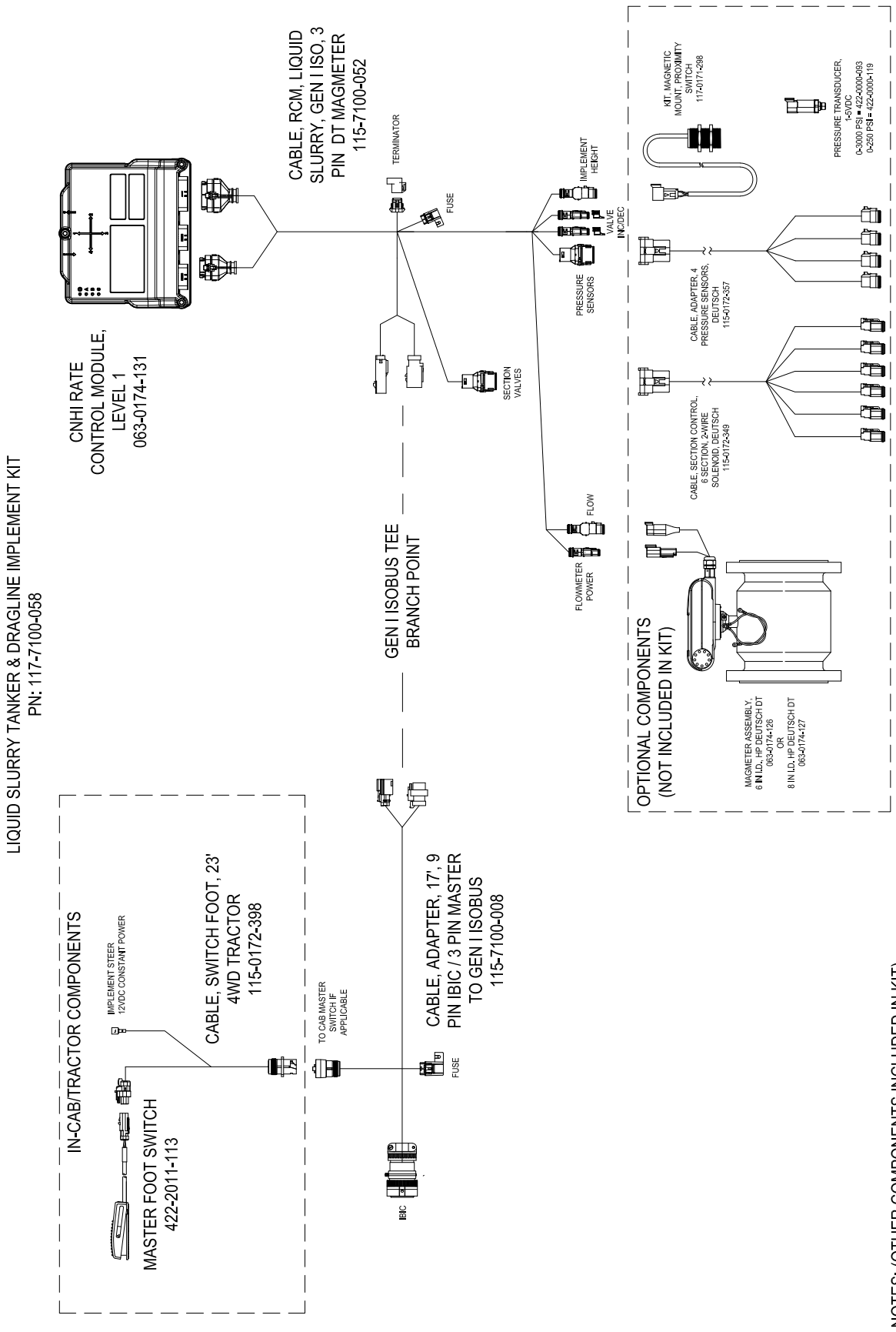
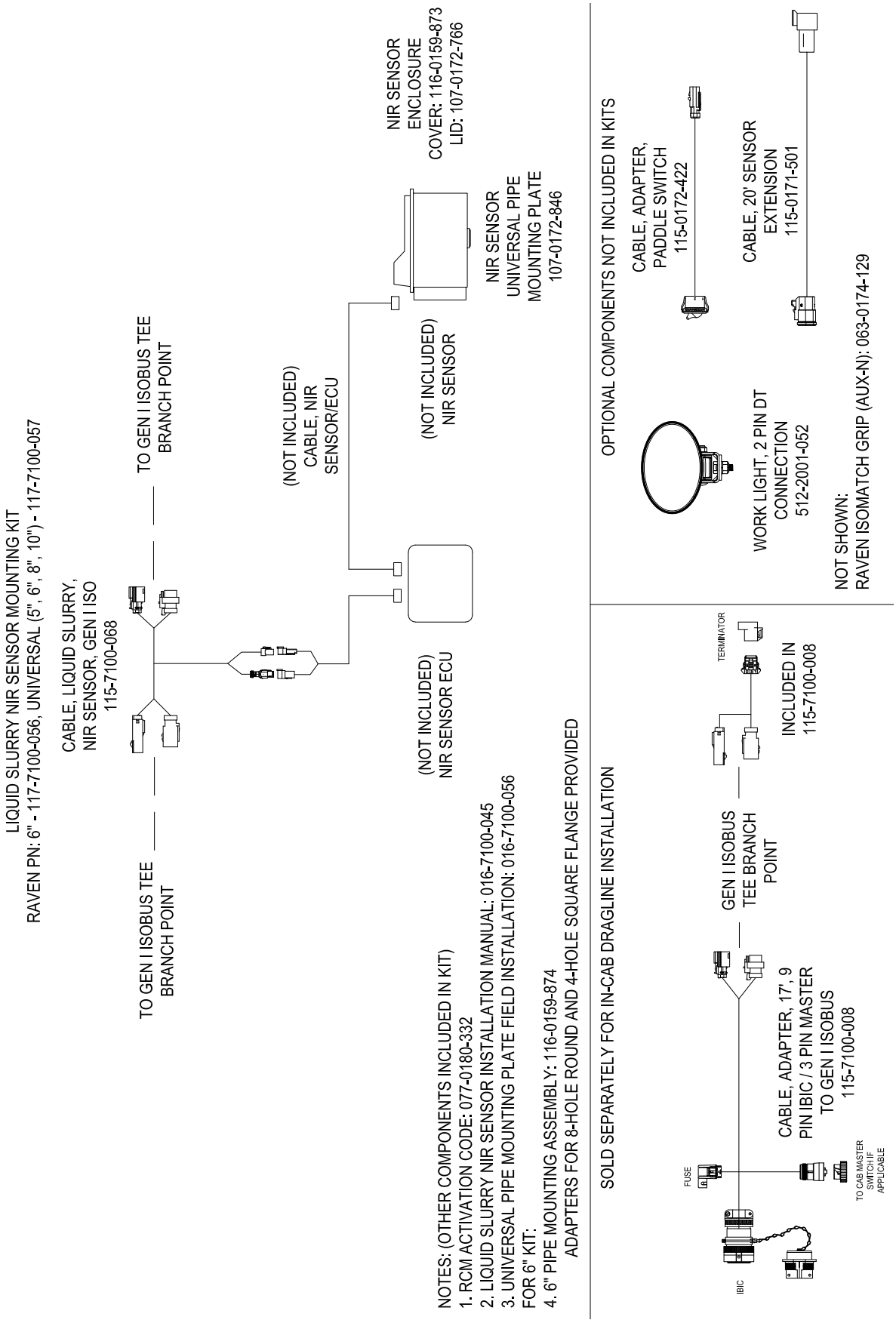


FIGURE 6. CNHi Rate Control Module Liquid Slurry System Drawing Pg. 2 (P/N 054-7100-057 Rev. C)



CHAPTER 4 RCM & NIR SENSOR ECU INSTALLATION

INSTALL THE RAVEN RCM AND NIR SENSOR ECU ON TANKER

1. Locate the Raven RCM and the NIR SENSOR ECU (KALI controller).
2. Identify a relatively protected and clean area on the slurry tanker as a mounting location.
3. Utilize magnets or custom bracket to mount the RCM and KALI ECU to the tanker.

NOTE: Orientation does not matter for the Raven RCM. Orientation is detected and set during calibration.

ROUTE CABLES ON TANKER

1. Identify the main NIR Sensor cable and connect the square connector to the sensor and route the cable down and around the tanker to where the KALI ECU is mounting.
2. Connect the black connector of the cable to the KALI ECU.
3. Identify the KALI ECU breakout cable and connect the gray connector of the cable to the KALI ECU.
4. Identify the liquid slurry Gen I ISO tee cable (P/N 115-7100-068) and connect the tee to the KALI ECU breakout cable.

FIGURE 1. ISO Tee Cable

5. Identify the liquid slurry RCM cable (P/N 115-7100-052) and connect the black and gray connectors to the RCM.
6. Connect the tee cable to the mating connections on the RCM cable. Check that the terminator is present on the RCM cable.

FIGURE 2. ISO Tee Cable Connected to RCM Cable

7. Route the remain connections from the RCM cable to the applicable sensors: Magmeter flowmeter, section valves, pressure sensor, implement height, and control valve.
8. Identify the Gen I ISO extension adapter cable (P/N 115-7100-008). and connect to the tee cable.
9. Route the cable to the back of the tractor and connect to the IBBC.
10. Use the foot switch cable (P/N 115-0172-398) to connect the foot switch (P/N 422-2011-113) to the system as desired.

INSTALL THE RAVEN RCM AND NIR SENSOR ECU ON DRAGLINE

1. Locate the Raven RCM and the NIR SENSOR ECU (KALI controller).
2. Identify a relatively protected and clean area on the slurry tanker as a mounting location.
3. Utilize a custom bracket to mount the RCM and KALI ECU to the tanker.

NOTE: Orientation does not matter for the Raven RCM, during calibration the orientation is detected and set.

An enclosure box can be used to protect the RCM and KALI ECU further.

FIGURE 3. NIR Sensor ECU Installed on Dragline

INSTALL THE RAVEN RCM AND NIR SENSOR ECU IN CAB

1. Locate the Raven RCM and the NIR SENSOR ECU (KALI controller).
2. Identify where in the cab to use as a mounting location.
3. Utilize magnets or a custom bracket to mount the RCM and KALI ECU to the tanker.

NOTE: Orientation does not matter for the Raven RCM, during calibration the orientation is detected and set.

The RCM is IP rated and can be installed on the outside of the machine.

ROUTE CABLES ON DRAGLINE

1. Identify the main NIR Sensor cable and connect the square connector to the sensor.
2. Route the cable along the dragline to where the KALI ECU is mounting.
3. Connect the black connector of the cable to the KALI ECU.
4. Identify the KALI ECU breakout cable and connect the gray connector of the cable to the KALI ECU.
5. Identify the liquid slurry Gen I ISO tee cable (P/N 115-7100-068) and connect the tee to the KALI ECU breakout cable.
6. Identify the Gen I ISO extension cable (P/N 115-7100-008) and connect to the tee cable and route the cable to the back of the tractor and connect to the IBBC.
7. Identify the RCM product cable (P/N 115-0172-633) and connect the two black connectors to the RCM.
8. Route the cable to the Magmeter flowmeter.
9. Identify the RCM cab ISO cable (P/N 115-0171-616) and connect the gray connector to the RCM and the cab ISO auxiliary port.
10. Connect the foot switch (P/N 422-2011-113) to the cab ISO cable as desired.

FIGURE 4. Cables Routed and Connected

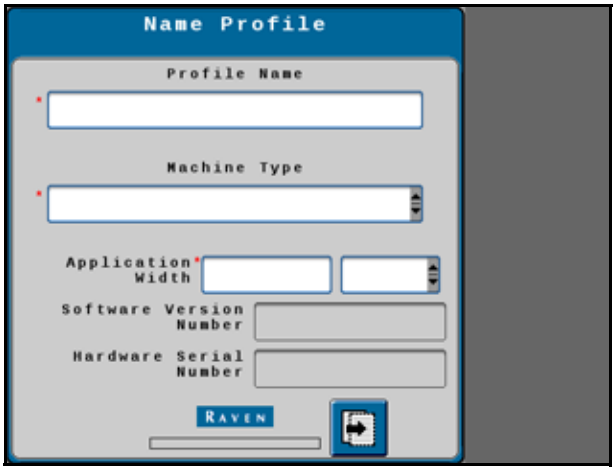
CHAPTER 5 INITIAL CALIBRATION

NIR SENSOR CALIBRATION WIZARD NOTES

NOTE: Complete the following calibration steps to setup an RCM for liquid manure applications using the Dinamica Generale NIR sensor. Refer to the RCM Operation Manual (P/N 016-0171-637) for assistance with setting up or operating the RCM in a liquid slurry application.

1. Enter the profile name for the implement.

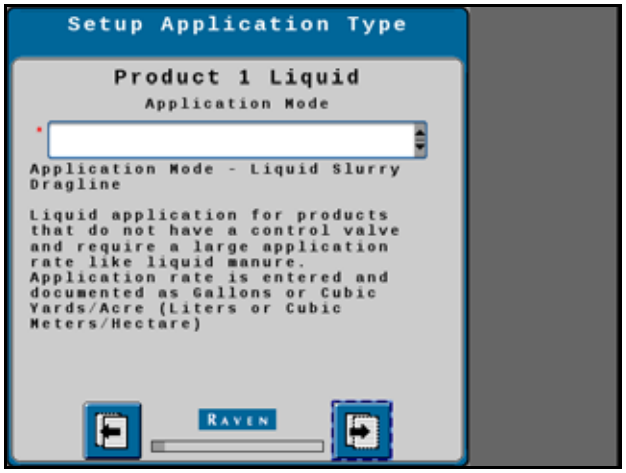
FIGURE 1. Name Profile Page



2. From the Machine Type drop-down options, select Liquid Fert. Tool.
3. Select the Next button in the lower, right corner of the page to proceed with the initial calibration until prompted to set the application mode.
4. Use the Application Mode drop-down list to select either Liquid Slurry or Liquid Slurry Dragline as the application type to be controlled by the RCM.

NOTE: A flow meter is required for the NIR system.

FIGURE 2. Setup Application Type Page



5. Select the Next button in the lower, right corner of the page to proceed until prompted to setup the NIR sensor.
6. To use near infrared (NIR) sensor data, select the NIR Sensor Enabled check box option.

NOTE: The NIR unlock (P/N 077-0180-332) for the RCM-U is required to enable the NIR sensor features.

If the unlock has not been applied, complete the setup wizard in absence of the NIR sensor configuration, apply the unlock, and then edit the profile to include the NIR sensor.

FIGURE 3. NIR Setup Page

7. Use the Task Controller Documentation Type drop-down to select one of the following options.

Advanced ISOBUS NPK. Nitrogen (N), Ammonium N (A), Phosphorus (P2O5), and Potassium (K2O) mode uses a specific structure for manure application reports and documentation. A field computer capable of operating in advanced ISOBUS NPK mode is required in order to document as-applied dry matter content.

NOTE: This option may not be compatible with all task controllers and may not be preferable for all application reporting requirements.

Generic ISOBUS Compatibility. This mode will generate a separate map or report layer for each product (PR1, N, A, P, K). VT capabilities may limit the number of products recorded.

Automatic. This mode will set the task controller interaction to the Advanced NPK type when a compatible CNHi or Raven task controller is detected and to Generic Compatibility for all other task controllers.

8. Select the Next button in the lower, right corner of the page and complete the remainder of the calibration wizard.

OPERATION NOTES

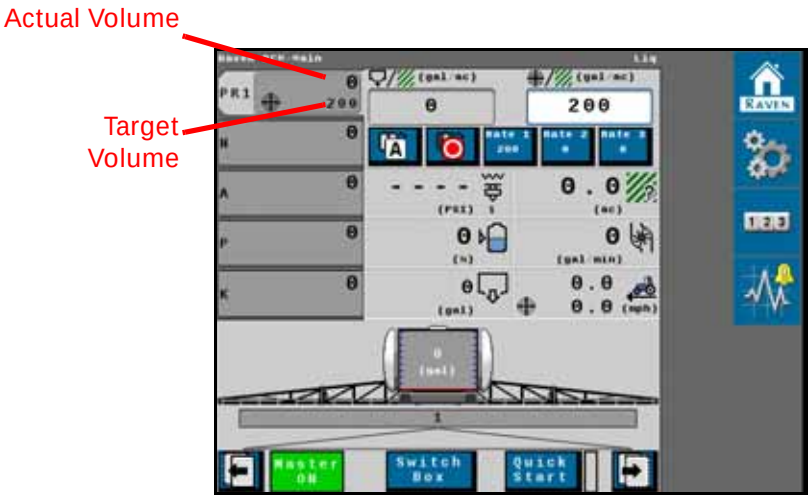
When configured for NIR operation, the RCM Home page provides much of the same functionality and navigation as a conventional multi-product Home page, but with a few differences based upon the nature of slurry and slurry dragline applications.

- Systems which do not have a control valve (e.g. a slurry dragline), the PR1 and NAPK target rate values may be left at zero (0) to record only the as applied rates.

NOTE: If a target rate is entered for PR1 or NAPK, the RCM will calculate a target speed for the machine operator.

- To apply at a target volume, set a desire PR1 target rate in volume per area. Nutrients will be reported in mass per area applied.
- If PR1 is not the controlled product, it will be recorded as volume per area applied instead of mass per area applied.
- The RCM is only capable of controlling the rate of one of the slurry nutrients at a time. Application of the remaining nutrients is logged in mass per area based upon the given ratios available in the slurry.
    - The total volume of slurry is recorded at the rate applied.
    - The nutrient or product to which RCM is controlling rate is shown as the highlighted tab (for example, PR1 as shown below).

FIGURE 4. Product 1 Active

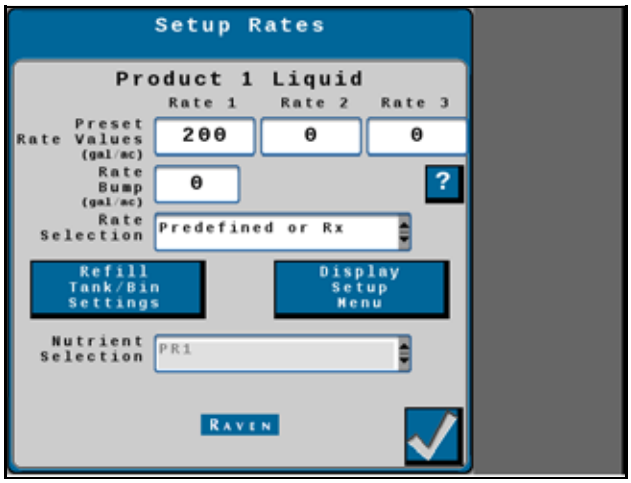


- When controlling nutrients or products in NIR mode, the bottom number on each nutrient tab is the percent of that nutrient in the total product volume.

- To change the active nutrient or product, tap the product tabs along the left of the home page to view the Setup Rates page. Next, use the Nutrient Selection drop-down (as shown in Figure 5 on page 28) to set the desired nutrient to which the RCM will control rate.

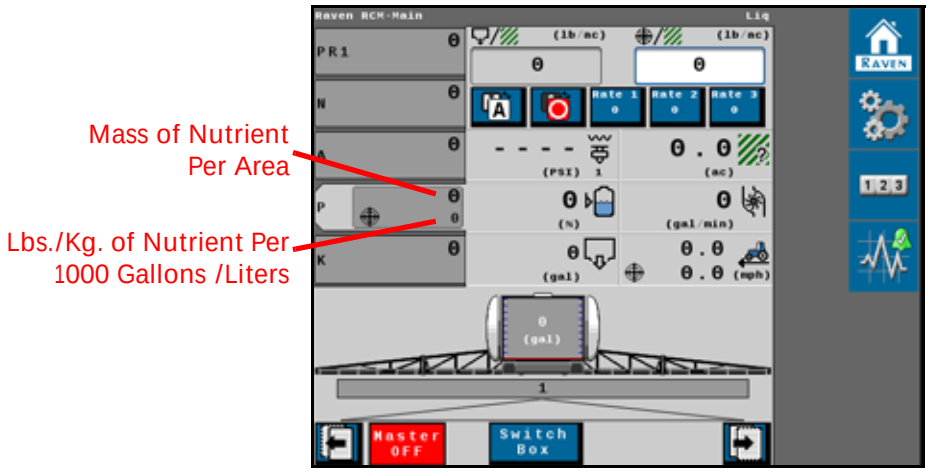
NOTE: It is only possible to change nutrient selections while not actively applying or in a job or task.

FIGURE 5. Setup Rates Page



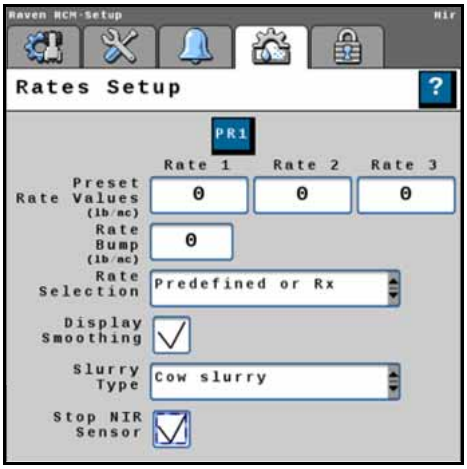
- The following image is an example using P (Phosphorus) as the active nutrient which RCM will control rate.

FIGURE 6. P as Active Nutrient



RATES SETUP PAGE NOTES

FIGURE 7. P as Active Nutrient



- Stop logging of the NIR sensor data by selecting the Stop NIR Sensor check box on the Rates Setup page.

NOTE: It is only possible to stop sensor logging while not actively applying with the master switch in the OFF position and with no active job or task on the display or field computer.

- Use the Slurry Type drop-down to calibrate the NIR sensor. Select the option which best describes the slurry being applied:
    - pig slurry
    - cow slurry (dairy)
    - digestate
    - mix slurry

NOTE: Consult NIR Sensor Operations Manual for selection recommendations.

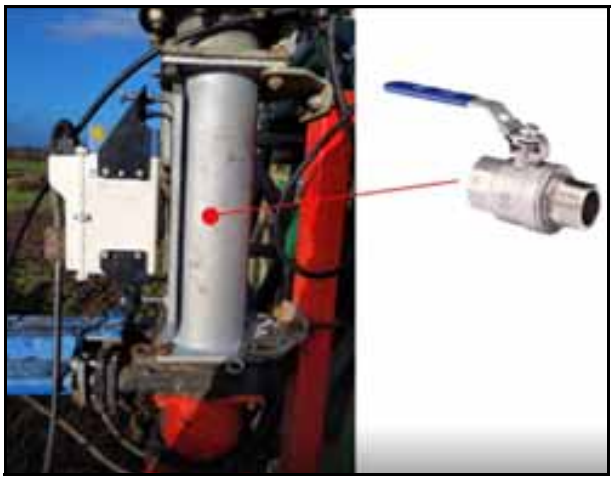
APPENDIX A

DINAMICA GENERALE NIR SENSOR SAMPLING AND CALIBRATION

SAMPLE LIQUID SLURRY FROM A TANKER

1. Ensure an access valve can be mounted close to the NIR sensor.

FIGURE 1. Access Valve Mount Location



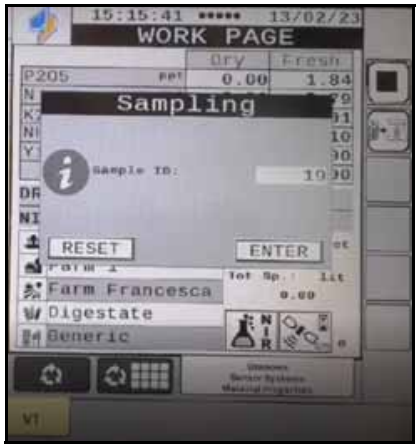
2. Begin slurry application in the field.

FIGURE 2. Field Application Screen (as shown in Dinamica Generale Universal Terminal working set)

3. Stop the tractor while the tank is still applying slurry.

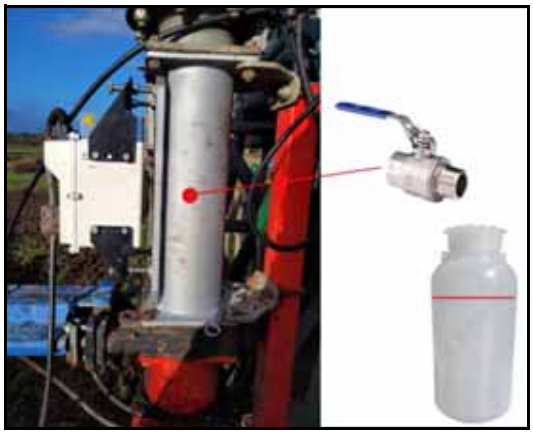
4. Select the SAMPLING button on the UT and press enter to initiate sample recording.

FIGURE 3. Sampling Screen



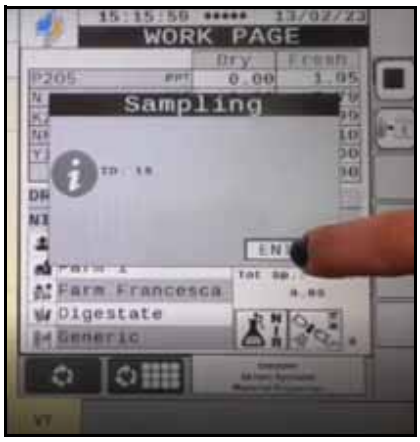
5. Fill lab sample bottle with slurry while sampling is running.

FIGURE 4. Sample Bottle and Access Valve



6. Let the sampling process complete on the UT.
7. Write the sample ID set displayed on UT on the bottle.

FIGURE 5. Sample Bottle with Sample ID



8. The minimum quantity for lab testing is 0.5 liter. Repeat the same operations at different points in the field to fill a minimum of five bottles with five samples. Samples can be across different loads. The best case is to supply one sample from five different loads for a total of five samples.
9. Send the bottles to the lab.

NOTE: See Appendix A, *Samples* for information regarding labs.

The lab samples must be received within 24 hours. If this is not possible, freeze the samples for 48 hours and ship to the lab for next day delivery.

SAMPLE LIQUID SLURRY FROM A DRAGLINE

1. Ensure an access valve can be mounted at the last stationary pump.

FIGURE 6. Access Valve Mount Location

2. Begin slurry application in the field.

FIGURE 7. Field Application Screen

NOTE: Based on application flow rate (volume/minute) and approximate volume between pump and applicator, determine approximate amount of time it takes for slurry to go from pump to applicator. In order to ensure sample collected is as close as possible to being representative of sensor sample, wait this amount of time from collecting sample to initiating sampling process on UT.

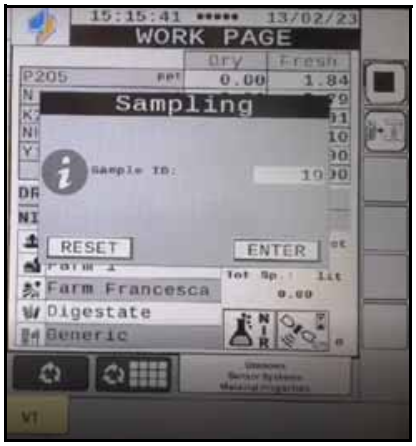
3. Retrieve a sample at the pump.

FIGURE 8. Sampling Screen

NOTE: Minimum quantity for lab is 0.5 liter.

4. After waiting approximate calculated time, press 'SAMPLING' button on the UT and press enter to initiate sample recording.

FIGURE 9. Sample Recording



5. Let the sampling process complete on the UT.

6. Write the sample ID set displayed on UT on the bottle.

FIGURE 10. Sample Bottle with Sample ID

7. Repeat the same operations at different points in the field to fill a minimum of five bottles with five samples. Try to spread out samples to about an hour apart.
8. Send the bottles to the lab.

NOTE: The lab samples must be received within 24 hours. If this is not possible, freeze the samples for 48 hours and ship to the lab for next day delivery.

DINAMICA GENERALE NIR SENSOR PROCESS FOR DLG CERTIFICATION

CALIBRATION METHOD

The aim of the DLG Test “Precision of NIR sensors for the determination of ingredients in passing liquid manure of animal origin and liquid digestate” is to examine the accuracies of mobile sensors in conjunction with appropriate calibration models in comparison to laboratory analysis with officially recognized methods.

A major advantage of NIR measuring technology compared to the conventional methods for the determination of ingredients in liquid manures through sampling and laboratory analysis, consists in the immediate availability of measurement results, and in the permanent measurement of the ingredients along the complete manure volume.

The scope in the DLG Test is limited on substrates, which are described as manure according to the Fertilizer Act (DuG), so on cattle manure, pig manure, mixed manure from cattle and pig manure, and liquid digestate from cattle or pig manure with renewable raw materials.

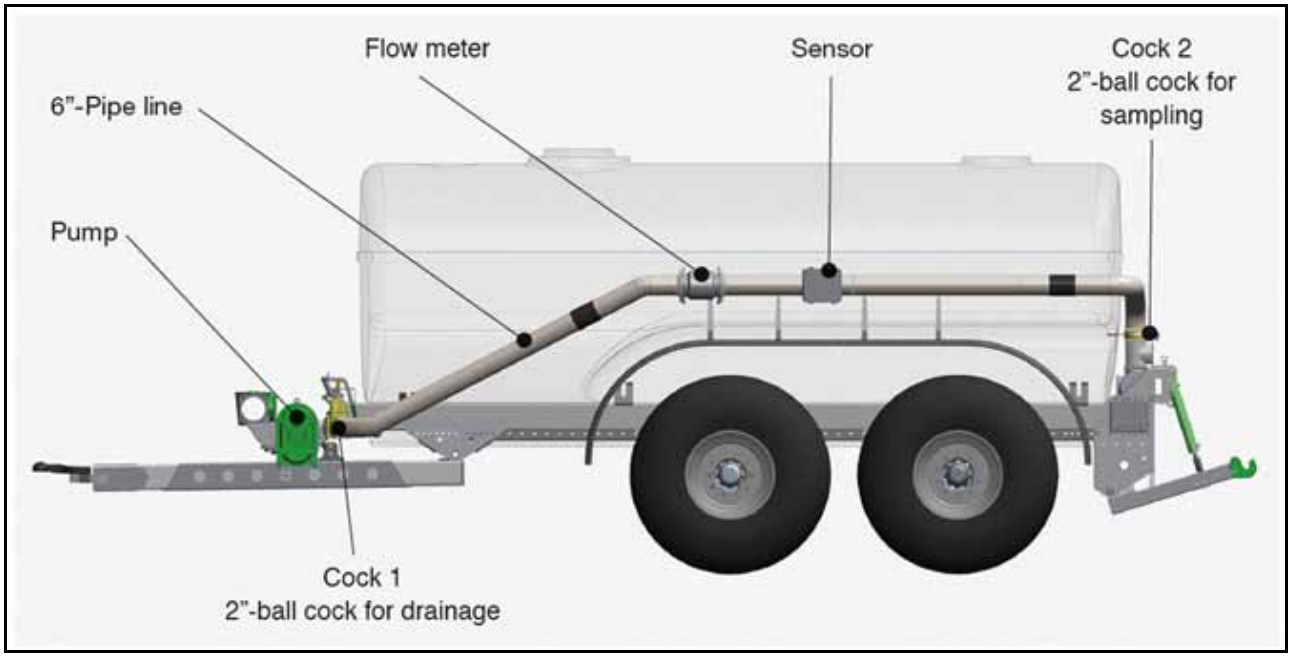
The DLG test is available for the measurement of the following ingredients:

- Dry matter content (DM in % Weight)
- Total Nitrogen amount (NTotal in kg/m3)
- Ammonium nitrogen amount (NH4N in kg/m3)
- Phosphate content (Phosphorous Pentoxide; P2O5 in kg/m3)
- Potassium (Potassium Oxide; K2O in kg/m3)

In order to cover a wide range of applications, the test attempts to use a diverse spectrum for each type of substrate:

- Cattle manure: 4% DM - 9% DM, where possible from dairy cows and fattened cattle
- Pig manure: 2% DM - 7% DM, where possible from sow-keeping + fattened pigs
- Mixed manure from cattle and pig manure: concentration series as follows:
    - 10% cattle; 90% pig
    - 30% cattle; 70% pig
    - 50% cattle; 50% pig
    - 70% cattle; 30% pig
    - 90% cattle; 10% pig
- Liquid digestate from cattle or pig manure with renewable raw materials: 5% DM - 8% DM.

FIGURE 11. Schematic Structure of the DLG Measuring System



The DLG approval can be awarded for individual types of manure and individual ingredients. To get a DLG recognition, at least the requirements for the measurement of the total nitrogen content (NTotal) need to be met. When the requirements for the measurement of the total nitrogen content are met, other ingredients can be freely chosen.

CALIBRATION PROCESS

Depending on each type of manure (cattle manure, pig manure, mixed manure from cattle and pig manure, liquid digestate from cattle or pig manure with renewable raw materials) five individual and as diverse as possible samples are measured and sampled on different farms. For this purpose, a subset of 3 to 5 cubic meters is pumped from the previously stirred slurry storage in an intermediate tank.

At the intermediate tank, a pump and a common piping system are installed. On the piping system one or more sensors to be tested and a bypass for sampling are attached. If necessary, a flow meter for the control of flow rates can be attached (Figure 11 on page 36).

In a preliminary phase the collected manure is intensively homogenized in the intermediate tank by continuous circulation in a closed circuit.

Following this preliminary phase, the measured values of the sensor are documented. Afterwards subsamples for the reference analyses are then taken via the bypass while maintaining inflation around the closed circuit. In order to determine any possible influence on the sensor values, subsequently the flow velocity is varied and the measured values are re-documented.

The manure samples are clearly marked, frozen and stored frozen. Five suitable laboratories are commissioned with the reference analysis. Each laboratory receives partial samples of each manure. The analyses in the laboratory must be carried out using officially recognized methods, preferably wet-chemical methods.

For each manure and each ingredient, the arithmetic mean value is calculated as a reference value from the laboratory results. The assessment of accuracy is based on the relative deviations from the sensor value in comparison with the reference value.

LIMITED WARRANTY

WHAT DOES THIS WARRANTY COVER?

This warranty covers all defects in workmanship or materials in your Raven Applied Technology Division product under normal use, maintenance, and service when used for intended purpose.

HOW LONG IS THE COVERAGE PERIOD?

Raven Applied Technology products are covered by this warranty for 12 months from the date of retail sale. In no case will the Limited Warranty period exceed 36 months from the date the product was issued by Raven Industries Applied Technology Division. This warranty coverage applies only to the original owner and is non-transferable.

HOW CAN I GET SERVICE?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including completed RMA form, Certificate of Decontamination, and retail proof of purchase) must be included inside the box to be sent to Raven Industries.

WHAT WILL RAVEN INDUSTRIES DO?

Upon confirmation of the warranty claim, Raven Industries will (at our discretion) repair or replace this product or any component of the product found to be defective during the warranty period. Replacement will be made with a new or remanufactured product or component. Standard return freight will be paid, regardless of inbound shipping method. Expedited freight is available at the customer's expense.

WHAT IS NOT COVERED BY THIS WARRANTY?

Raven Industries will not assume any expense or liability for repairs outside our facility without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit, labor, or other damages. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

- Damages caused by normal wear and tear, misuse, abuse, neglect, accident, improper installation and maintenance are not covered by this warranty.
- Worn/Chafed hoses and cables.
- Items in contact with fluids and chemicals including seals and O-rings.
- Software downloads and updates.
- Tamper-Evident label broken or customer disassembly.
- Any customer modification to the original product outside normal calibration and adjustments, without written approval.
- Intentional modification to cables.
- Failures due to lack of cleaning or preventive maintenance, and any condition, malfunction or damage not resulting from defects in material or workmanship.
- Items in contact with fluids or chemicals, returned without proper cleaning, decontamination and documentation.

EXTENDED WARRANTY

WHAT DOES THIS WARRANTY COVER?

This warranty covers all defects in workmanship or materials in your Raven Applied Technology Division product under normal use, maintenance, and service when used for intended purpose.

DO I NEED TO REGISTER MY PRODUCT TO QUALIFY FOR THE EXTENDED WARRANTY?

Yes. Products/systems must be registered within 30 days of retail sale to receive coverage under the Extended Warranty. If the component does not have a serial tag, the kit it came in must be registered instead.

WHERE CAN I REGISTER MY PRODUCT FOR THE EXTENDED WARRANTY?

To register, go online to https://portal.ravenprecision.com and select Product Registration.

HOW LONG IS THE EXTENDED WARRANTY COVERAGE PERIOD?

Raven Applied Technology products that have been registered online are covered for an additional 12 months beyond the Limited Warranty for a total coverage period of 24 months from the date of retail sale. In no case will the Extended Warranty period exceed 36 months from the date the product was issued by Raven Industries Applied Technology division. This Extended Warranty coverage applies only to the original owner and is non-transferable.

HOW CAN I GET SERVICE?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including completed RMA form, Certificate of Decontamination, and Extended Warranty Registration Number) must be included inside the box to be sent to Raven Industries. In addition, the words "Extended Warranty" must appear on the box and all documentation if the failure is between 12 and 24 months from the retail sale.

WHAT WILL RAVEN INDUSTRIES DO?

Upon confirmation of the warranty claim, Raven Industries will (at our discretion) repair or replace this product or any component of the product found to be defective during the warranty period. Replacement will be made with a new or remanufactured product or component. Standard return freight will be paid, regardless of inbound shipping method. Expedited freight is available at the customer's expense.

WHAT IS NOT COVERED BY THE EXTENDED WARRANTY?

Raven Industries will not assume any expense or liability for repairs outside our facility without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit, labor, or other damages. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

- Damages caused by normal wear and tear, misuse, abuse, neglect, accident, improper installation and maintenance are not covered by this warranty.
- Worn/Chafed hoses and cables.
- Items in contact with fluids and chemicals including seals and O-rings.
- Software downloads and updates.
- Tamper-Evident label broken or customer disassembly.
- Any customer modification to the original product outside normal calibration and adjustments, without written approval.
- Intentional modification to cables.
- Failures due to lack of cleaning or preventive maintenance, and any condition, malfunction or damage not resulting from defects in material or workmanship.
- Items in contact with fluids or chemicals, returned without proper cleaning, decontamination and documentation.