

KONTROL-FLO II™

Control and Monitoring System for Anhydrous Ammonia or Liquid Product Application

Introducing Squibb-Taylor's Affordable, Computer Controlled NH₃/Liquid Application System Featuring either GPS or Radar Technology and New Precision Flow Meter

Accurately measuring the flow rate is critical to any precision NH₃ application system. Conventional systems use a heat exchanger or liquifier in an attempt to remove the vapor from the liquid before it is measured by a turbine meter. Any vapor flowing through the turbine meter will produce a higher than actual flow indication - resulting in a lower than expected applied pounds per acre. When the nurse tank runs empty, the liquifier will no longer prevent vapor from flowing through the turbine meter. The turbine will spin at high rates and eventually result in meter failures or damage to the turbine's bearings. Worn or damaged turbine bearings cause permanent errors in the flow readings and result in over application.

Kontrol-Flo II is a unique new control and monitoring system. The flow rate is measured by a flow meter developed specifically for NH₃ application. The meter is immune to high velocity vapor flow and debris in the liquid. Using patent pending algorithms to compensate for vapor in the liquid, the heat exchanger or liquifier is eliminated. In addition to removing one of the most expensive components, the system installation is simpler. A digital temperature probe was added to measure the liquid temperature and make automatic corrections to the flow rate as NH₃ density changes.



The controller uses an optional GPS receiver to accurately measure the true tractor speed. This is the same technology used in state of the art precision farming systems costing thousands more. A low cost GPS receiver is inside the controller housing and the antenna has a magnetic base simplifying installation. Adding precision ground speed measurement could not be easier, and if all you want to do is measure acreage, it can do that too. If your tractor already has radar, the Kontrol-Flo II can optionally interface with it for accurate ground speed measurement.

All of the components for the Kontrol-Flo II system were designed to work together. Unlike systems that are pieced together from several manufactures, this system is ready to use.

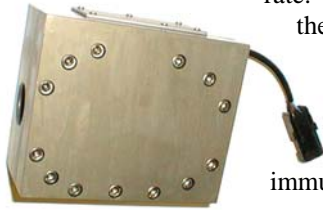
The Kontrol-Flo II is an accurate, feature-packed system providing NH₃ application performance comparable to the most expensive systems at a significantly lower cost. In addition, accurate speed measurement can be accomplished using the global positioning system, GPS, to automatically correct the flow rate for ground speed fluctuations or existing on-board radar. The Kontrol-Flo II is easy to install and very user-friendly.

MODEL	NPT INLET/OUTLET	GPM OF NH ₃	GPM OF LIQUID
A1668	1"	3.0 - 30	2.5 - 23
A1670	1-1/4"	4.5 - 45	3.5 - 35

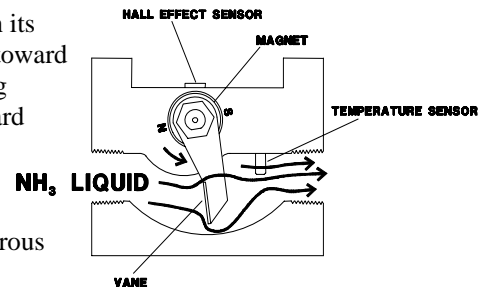


Variable Area Flow Meter

The Kontrol-Flo II's Variable Area Flow Meter measures the NH₃ liquid flow rate. In other application systems the flow meter is the most delicate component, and a turbine meter is typically used to measure the liquid flow rate. When the nurse tank runs empty, vapor begins to flow through the flow meter, spinning the turbine at high rates, and results in meter failures or damage. Kontrol-Flo II's Variable Area Flow Meter is immune to the high velocity vapor flow rates caused by a tank running empty or nurse tank debris. In addition, the meter does not require a straight section of pipe before the meter. Flow readings are transmitted to the controller using industrial 4-20 milliamp current loop communication, a system noted for its immunity to voltage noise that causes flow measurement errors.



The Variable Area Flow Meter's operation is based upon its measuring cavity, which is smaller on the inlet side, and increases linearly toward the outlet side. A vane is mounted in the flow stream and a precision spring holds the vane toward the inlet. As flow increases, the vane is pushed toward the outlet by the liquid flow until the force from the liquid is equal to the torque on the vane applied through the spring. The position of the vane is measured to determine the flow rate. A sensor in the liquid stream measures the liquid temperature to correct for density changes as the anhydrous ammonia warms throughout the day.



The Variable Area Flow Meter is a simple, reliable meter with excellent repeatability, and unlike turbine meter systems, this meter is designed to be rugged and trouble free.

Controller

The Controller, mounted inside the tractor cab, allows the operator to monitor and adjust the NH₃ or liquid product flow rate. In NH₃ applications, the controller monitors the flow rate and NH₃ temperature to determine the measured flow rate. The measured flow rate is then offset to compensate for vapor to determine the actual flow. The actual flow is compared to the desired flow and adjustments are made to the control valve to maintain an accurate application rate.



The controller's two level menu system allows the user to quickly:

- adjust swath width
- set the application rate in pounds N per acre or gallons per acre
- set alarm levels, clear the total acres and total gallons counters
- adjust vapor compensation

It can also monitor:

- NH₃ temperature
- flow rate in GPM
- total gallons flowed
- actual pounds N or gallons per acre
- acres covered (during application or independently)
- tractor speed

Settings and totals are saved in non-volatile memory so the operator doesn't have to re-program after switching the controller off.

When the controller is first turned on, the system will perform several internal tests to verify that the equipment is functioning properly. The display will alert you of any possible problems. After loading the current settings from memory, the controller checks to see if a GPS receiver or radar interface is installed. If a GPS is found, the controller will wait for the GPS to finish downloading information from satellites. If no GPS is found, the fixed tractor speed is loaded from memory and displayed on the controller screen. You are ready to make configuration changes or begin dispersing anhydrous or liquid.

The controller is simple to operate, and has a large backlit LCD display that is easy to read in any lighting situation, big toggle switches (not a flat keypad) and a tough anodized aluminum case. A single 35-ft. control cable with weatherproof connectors links the controller to the flow meter and control valve.

Control Valve



The Control Valve adjusts the flow to maintain a consistent application rate. The valve position is controlled by a DC gear motor and indicated by the valve position indicator on the valve drive shaft. The position indicator provides a quick visual indication of how far open or closed the valve is at any time.

The controller will make automatic adjustments to the valve to maintain the desired flow rate. The valve can also be adjusted manually at any time by toggling the FLOW switch on the controller to increase or decrease the flow rate. Using the FLOW switch also switches the controller to manual control. In manual mode, the controller will not make automatic adjustments to the control valve. Toggle CANCEL to return to automatic control.

Control Cable

The control cable connects the controller to the flow meter and the control valve. The weatherproof connectors are keyed so that they can only be connected to the correct devices. The controller can be up to 35 feet from the flow meter and control valve. The flow meter and the control valve are usually screwed together.

Optional Extension Cable

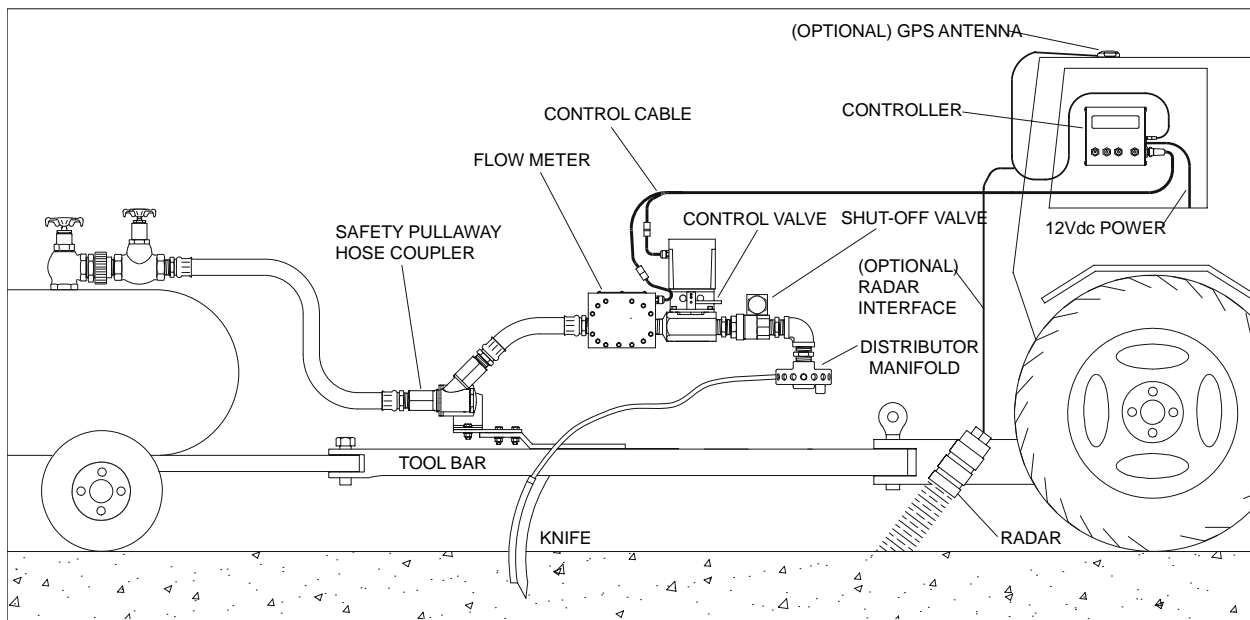
An optional extension cable adds 20 feet to the control cable. It can also be used to provide a cable connection between the tractor cab and the toolbar or hitch.



Radar Ground Speed

The Kontrol-Flo II controller can be upgraded to include a radar interface to measure accurate tractor ground speed using radar. The Kontrol-Flo controller uses a Dickey-John type 4-pin connector. The interface is compatible with most radar units but may require a special cable to connect to the tractor harness or radar. Various cables are available.

Typical NH₃ Installation



GPS Ground Speed

The Kontrol-Flo II controller can be upgraded to include a GPS receiver to determine the tractors true ground speed. An accurate speed is critical in maintaining the exact desired flow rate and can significantly improve application accuracy.

- Maintains high accuracy at all speeds, unaffected by vibration, waving weeds, or field debris that interfere with radar speed systems
- Quick simple installation and setup at a low cost

What is GPS?

The U.S. Department of Defense developed the Global Positioning System, (GPS) for navigation. It's based on a constellation of 24 satellites orbiting the earth at a very high altitude giving pinpoint positions anywhere in the world, 24 hours a day.

How GPS Works

GPS is based on satellite ranging. A position on earth is determined by accurately measuring the distance from a group of satellites in space. The distance to a satellite is determined by measuring how long a radio signal takes to reach the receiver. By using the distance measurement of a minimum of four satellites, and knowing the locations in space of the satellites, the GPS can triangulate a position on earth including altitude. To determine speed-over-ground two positions are measured exactly one second apart. The distance in feet between the two positions is the speed in feet per second. The Kontrol-Flo controller displays the speed in miles per hour.

Kontrol-Flo II GPS

The GPS receiver in the Kontrol-Flo controller is capable of tracking up to 8 satellites at any one time to compute speed information with an accuracy of better than +/- 0.1 miles per hour. This accuracy shows that the more expensive DGPS is not required. DGPS (Differential GPS) is a more sophisticated form of GPS using a reference station at a fixed site to transmit location corrections to the DGPS receiver. While the corrections can significantly improve position accuracy, the speed accuracy has only minor improvements.

Adding GPS to the Kontrol-Flo Controller

The GPS receiver board is installed inside the controller housing. The controller automatically checks for a GPS receiver when it performs its power on testing, and uses the GPS ground speed if the receiver is detected. The antenna receives GPS satellite information to determine true ground speed. The compact magnetic mount antenna is weatherproof and has a five-meter cable.



GPS Antenna

Specifications

Flow Meter

1" NH3 Flow Range.....	3.0 to 30 GPM
1" Water Flow Range.....	2.5 to 23 GPM
1" Inlet and Outlet Ports.....	1" Female NPT
1-1/4" NH3 Flow Range.....	4.5 to 45 GPM
1-1/4" Water Flow Range.....	3.5 to 35 GPM
1-1/4" Inlet and Outlet Ports.....	1-1/4" Female NPT
Working Pressure.....	400 PSIG max
Operating Temperature.....	-20 to 125°F
Power Requirements.....	10 to 15 Vdc, .05 Amps max
Flow Telemetry.....	4-20ma
Temperature Probe Range.....	-50 to 200°F
Temperature Telemetry.....	Bi-directional Digital Serial Link

Controller

Power Requirements (Running).....	10 to 15 Vdc, 1 Amp max
Power Requirements (GPS Standby).....	6 to 15 Vdc, .005 Amps max
Fuse.....	3 Amp Fast Acting AGC (Littelfuse 312003 or equivalent)
Operating Temperature.....	30 to 125°F
Storage Temperature.....	-40 to 150°F
Humidity.....	95% R.H. non-condensing
Screen Update Rate.....	1 second
Enclosure.....	Extruded black anodized aluminum
Display.....	back-lit 2 line by 16 character LCD

Flow Control Valve

1" Inlet and Outlet Ports.....	1" NPT
1-1/4" Inlet and Outlet Ports.....	1-1/4" NPT
Working Pressure.....	400 PSI max
Operating Temperature.....	-20 to 125°F
Power Requirements, To Open or Close.....	10 to 15 Vdc, 0.2 Amp max
Actuation Speed.....	Approx. 30 seconds from full closed to full open

GPS Receiver

Velocity Accuracy.....	0.1m/sec steady state conditions without SA
Acquisition Rate, Cold Start.....	< 2 minutes
Acquisition Rate, Hot Start.....	< 20 seconds

Radar Interface

Connector.....	4-Pin AMP, Dickey-John compatible
1.....	Ground
2.....	Signal Input
3.....	+12V, 1/2 Amp Max
4.....	no connection
Maximum Frequency.....	4,000Hz
Pulse (High Level).....	5 to 15 Volts
Pulse (Low Level).....	Less than 1.5 Volts