



— Series — **VSU**

## Valve Station Remote Terminal Units



- Wireless remote monitoring and control of valve stations
- Integrated RTU with built in 900 MHz spread spectrum radio
- Interfaces with all types of analog sensors and digital switches
- Simple interfacing with Cla-Val electronic valve controllers, pilot valve actuators, solenoid operated valves, and valve sensors
- VSC Base Station module communicates with up to 95 valve stations
- VSS Expansion modules for multi-valve stations
- Efficient "Report on exception" radio transmission minimizes radio traffic interference
- Low power 24 VAC/VDC or solar powered 12 VDC input

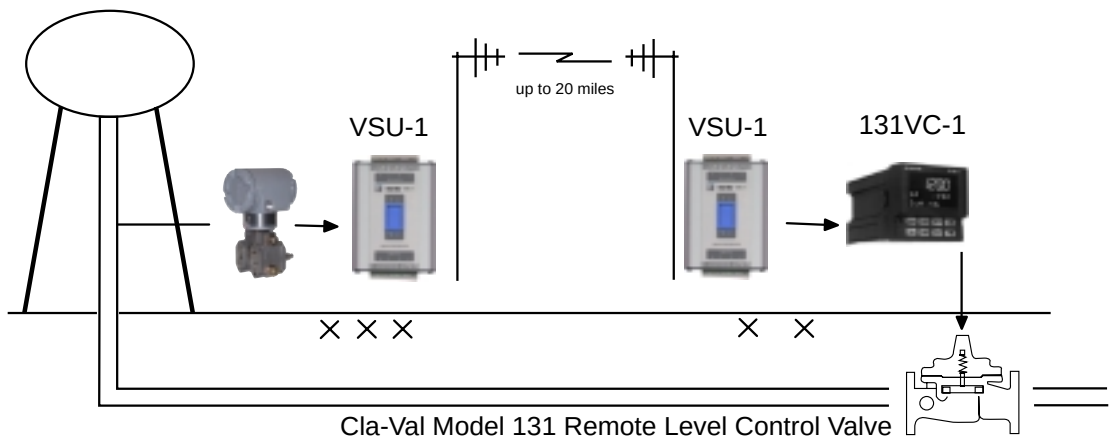
Cla-Val Remote Telemetry Units are designed to make monitoring and control of valve stations simple and inexpensive using spread spectrum 900 MHz radio communications.

The RTU's accept 4-20 analog inputs from flow, pressure, and level sensors and output analog signals for remote set point control of Cla-Val 131VC series electronic controllers, 130 VC Series pilot valve actuators and other similar devices. The RTU's also accept all types of digital inputs and outputs (I/O). Digital inputs include valve limit switches, level switches, intrusion alarms, or pulse inputs from pulse output type flow meters. Digital outputs include solenoid Open/Close commands to Cla-Val pressure reducing, pressure sustaining flow control and on/off control valves.

### Wireless Valve Control

A typical wireless level control application is made up of two VSU-1 modules. One module accepts a 4-20 mA level signal at a reservoir and transmits it to a remote valve VSU module, which outputs the same 4-20 mA signal into a 131 VC electronic valve controller, which modulates the valve. Alternatively, for simple on/off altitude control the VSU may have setpoints programmed to open the valve at a low level and to close the valve at a high setpoint level.

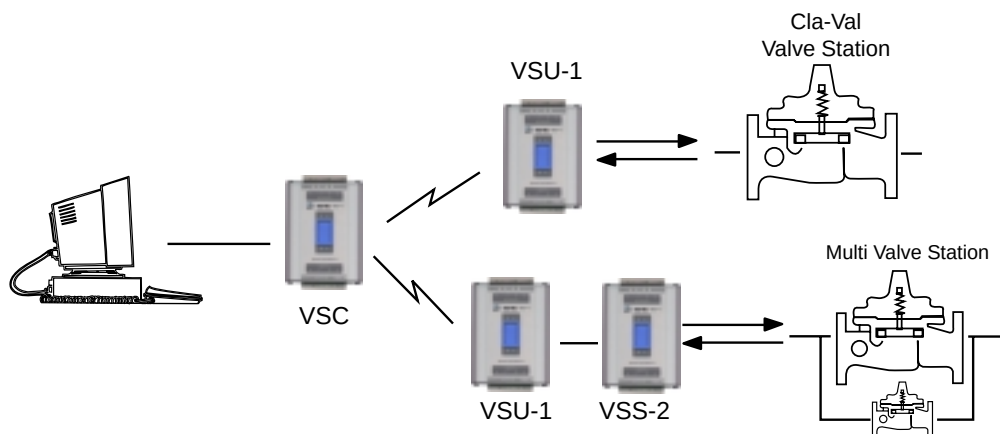
- Level switch input may also be used
- On/off or modulating control
- Remote solar powered capability
- Easily expanded with VSS or VSC Base Station modules



## Valve Station SCADA

For remote monitoring and control of valve stations, a VSC Base Station RTU will communicate with up to 95 VSU valve station modules. The VSC provides a Modbus interface to host devices such as SCADA computers or PLCs with capacity of 4800 registers to send and receive information from all valve stations.

A typical station will have valve inlet and outlet pressure, flow, and position transmitters that provide 4-20 mA analog input information to the VSU. In addition, solenoid shutoff and electronic valve control which require on/off and setpoint commands to close the valve or change set points, will also be provided by the VSU. The VSU-1 transmits information to the VSC Base Station RTU that is connected to a PC or PLC with software for the supervisory control and data acquisition of the valve station.



Up to 95 Cla-Val VSU modules may communicate with one VSC Base Station and up to 31 VSS expansion modules may be connected to each VSU module. VSS modules provide extra sensor input, command output capability, and communicate with VSU modules through a RS485 serial connection. VSU/VSC modules may also be used as repeaters to establish communication around obstacles such as hills, buildings, and trees.

## Simple Interfacing

### Inputs

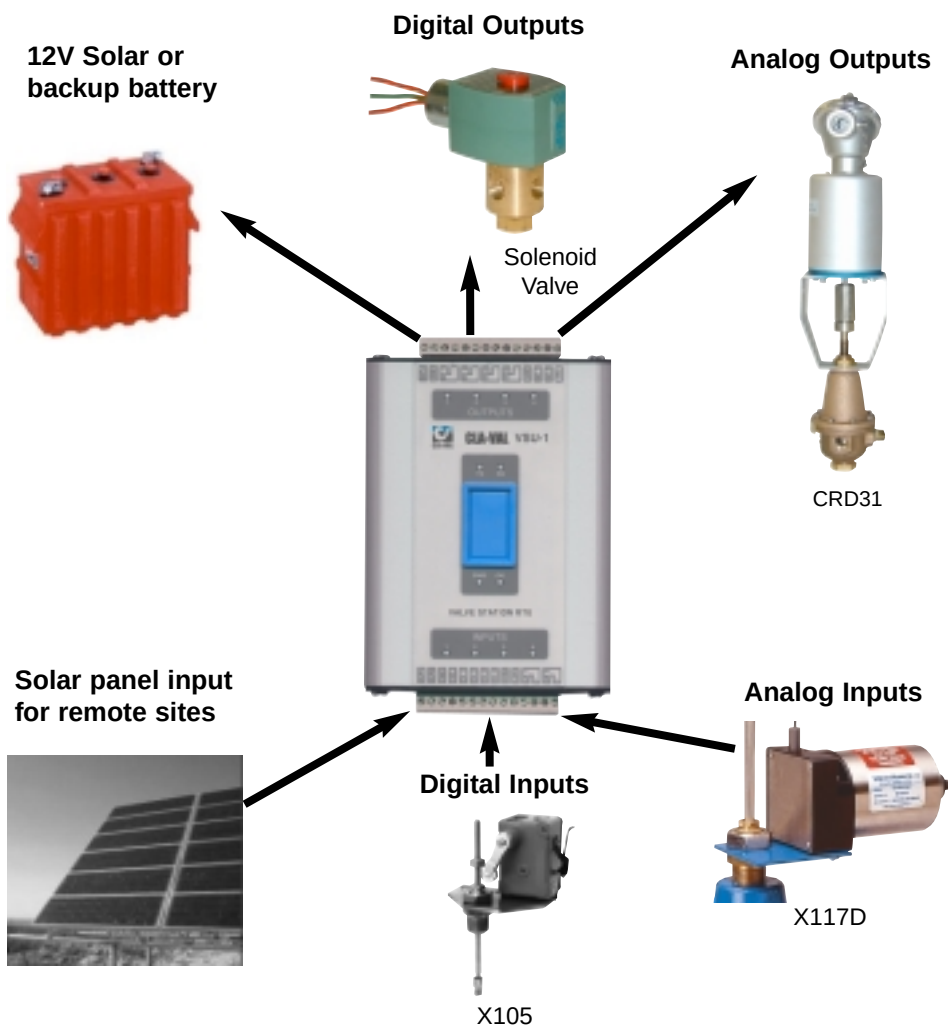
The Cla-Val VSU is versatile for all types of valve sensors and controls. Analog input 4-20 mA transmitters such as position, pressure, flow, and level are accepted. 24 VDC is available to power all loops if required. Digital inputs for valve limit switches, level switches, and intrusion switches etc. are also accepted. The Cla-Val VSU also accepts digital Pulse inputs from turbine flowmeters for flow monitoring.

### Outputs

Digital Outputs provide contacts for energizing a solenoid for opening or closing a valve. Analog Outputs provide 4-20 mA setpoint commands to pilot valve actuators or 131 series electronic valve controllers.

### Power

The VSU accepts either 24 Volts AC or DC power with 12-volt battery back-up. A built in regulating charger controller keeps the battery fully charged. If power is not available, the VSU accepts solar panel (up to 30 watts) with solar battery operating power.



## Module Selection Steps

1. Determine the number of Digital Inputs (switches), Digital Outputs (solenoids etc.), Analog Inputs (4-20 mA sensors), and Analog Outputs (4-20 mA RSP commands).
2. Select either a VSU-1 or VSU-2 radio module.
3. Select additional VSS expansion units if required.
4. Add a VSC Base Station unit for interface to PC or PLC (not required for wireless valve control).

Example: A metering valve station with solenoid shutoff has upstream pressure, differential pressure and position transmitters, and valve limit switches. A VC-3 flow controller provides 4-20 mA flow retransmission and accepts a 4-20 mA Remote Setpoint command. This station requires a VSU-1 radio module and a VSS-2 serial expansion module. The VSS-2 connects to the VSU-1 via RS485 serial (twisted pair) wire.

## Module Selection Chart

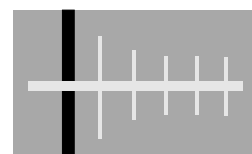
|                 | VSU-1 | VSS-1 | VSU-2 | VSS-2 |
|-----------------|-------|-------|-------|-------|
| Radio           | X     |       | X     |       |
| Serial          |       | X     |       | X     |
| Digital Inputs  | 4     |       | 4     |       |
| Digital Outputs | 4     |       | 1     |       |
| Analog Inputs   | 2     |       | 6     |       |
| Analog Outputs  | 2     |       | 0     |       |
| Pulse Inputs    | 1     |       | 4     |       |
| Pulse Outputs   | 1     |       | 0     |       |

## Radio Path Considerations



Dipole antenna

Omni-directional antennas provide communication in all directions while directional antennas only communicate in one direction. A dipole antenna is an omni-directional antenna that is capable of receiving and transmitting up to 5 miles line of sight. For distances up to 8 miles, a collinear antenna is available. For distances up to 15 to 20 miles a directional Yagi antenna is required. Cla-Val offers six element and 16 element Yagi antennas for these applications.



Yagi antenna

If line of sight communication is unavailable due to obstructions such as buildings, hills, or trees then a repeater may be necessary. The Cla-Val VSU and VSC modules may also perform this function. Communication with a remote site is then accomplished by designating the repeater site to "store and forward" the information to the remote module. Up to five repeaters may be used to either increase distance of coverage or communicate around obstacles.

Radio path calculations can be made to determine the effect of distance, relative height, antenna type, cable length, and obstructions on signal strength. This aids in selection of proper antenna and cable and determines if a repeater module is necessary. Radio path testing is easily carried out utilizing two radio modules and a laptop PC to verify signal strength.

The advanced "frequency hopping" technology minimizes radio interference. If a transmission is not received properly, it is rejected and the transmitting module resends on a different frequency to avoid transmission error. If communication failure occurs, an internal status register allows the module to reset a digital or analog output to close the valve or change setpoint for failsafe operation.

## SCADA System Integration

The Cla-Val valve station RTUs may operate as a stand-alone system or be integrated into larger SCADA systems. Cla-Val V-SCADA software, a Microsoft Excel based program, allows monitoring and control of a small-scale "mini-SCADA" system. With V-SCADA software it is possible to communicate with all valve stations, send on/off or setpoint commands, and graphically display and log all valve parameters at each site. PC requirements are Microsoft Windows 98 and Excel 97 or later with an available serial communications port. V-SCADA saves data to an ASCII database file for later retrieval by Excel or Microsoft Access. Optional Cv-Flow feature provides capability to display flow rate and total flow through Cla-Val Hytrol and 600 Series valves based on valve position and differential pressure inputs.

For large scale or existing SCADA systems, the Cla-Val VSC may be connected to PCs or PLCs, which utilize "Modbus RTU" protocol. The VSC acts as a Modbus slave and responds to commands from a Modbus master PC or PLC. A printout of register numbers is provided to allow, "tagging" by the PC or PLC software. In this manner, the valve station information may be integrated into a water district's management system.



VSC Base Station & V-SCADA software

## Installation

All Cla-Val Valve Station RTU modules may be quickly mounted inside an electrical enclosure on a DIN rail. Terminal strips are removable for easy wiring of power and I/O. Expansion VSS modules may be installed initially or added later. Connection to the VSU is by twisted pair wire (RS485).

Antennas are mounted on masts with provided brackets. Adequate signal strength requirements will determine antenna mounting height and cable length. Radio signal strength testing is easily performed to verify adequate signal.

Lightning surge diverters are available for protection of the electronic equipment. Proper grounding is necessary for the mast, surge diverter, and VSU modules.

## Purchase Specifications

Model VSU-1, VSU-2, VSS-1, and VSS-2 VALVE STATION RTUs  
Model VSC BASE STATION

### Function

The valve station RTU shall provide a means for remote monitoring and control of Cla-Val control valves using 900 MHz Spread Spectrum Radio (SSR). There shall be no licensing costs or operating costs for communication between any of the RTU modules.

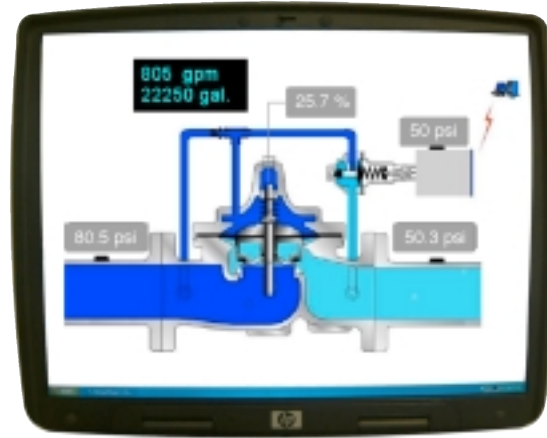
The VSU and VSC modules shall have integrated SSR and shall not require a separate radio modem for communication to other valve sites or base station. The modules shall have capability to accept Digital Inputs (DI), Digital Outputs (DO), Analog Inputs (AI), and Analog Outputs (AO).

The VSS shall provide expansion of inputs and outputs at the valve site and shall communicate with the VSU radio module via RS485 serial communications with twisted pair wire. Each VSU module shall accept up to 31 VSS expansion modules. Each field module model shall have the following communications capability and types of inputs and outputs.

VSU-1 – SSR Radio, 4DI/4DO/2AI/2AO  
VSU-2 – SSR Radio, 4DI/1DO/6AI/0AO  
VSS-1 – Serial, 4DI/4DO/2AI/2AO  
VSS-2 – Serial, 4DI/1DO/6AI/0AO

The VSU and VSS modules shall accept input power of either 15-30 VDC, 12-24 VAC, or 11.5 to 15 volts battery supply power for backup. Each module shall also accept up to 30-Watt solar panel and have an integral charging regulator for up to 100 Amp-Hr solar battery.

Each module shall have a DC-to-DC converter to provide 150 mA of 24 VDC loop power for 4-20 mA analog input transmitters. Analog inputs shall have accuracy of .1%. The VSU-1 and VSS-1 shall have one Digital Input capable of accepting pulse inputs from flowmeters of up to 100 Hz. The VSU-2 and VSS-2 shall have four Digital Inputs with the same capabilities except one (DI1) with maximum of 1000 Hz input. Both pulse rate and pulse count may be remotely read for monitoring flow rate and total flow.



V-SCADA real-time valve information display

Each VSU shall be capable of communicating via SSR directly with any other VSU for wireless valve control. Radio transmissions shall occur if there is a change of state of a digital input or an analog input sensitivity and at a programmed update time. Each data transmission shall be error checked using 16-bit Cyclic Redundancy Checking.

Error free transmissions shall be automatically acknowledged with up to five retries before communication failure status is set. Resetting of outputs on communication failure shall be configurable for failsafe operation.

Each VSU shall be capable of communicating with a VSC Base Station unit. The VSC shall have 4800 Input and Output registers for communication with up to 95 addressable remote VSU modules. The VSC Base Station shall be a Modbus RTU slave unit that responds to commands from an external Modbus master such as a PC or PLC. Communication with a PC or PLC shall be through a serial port RS232 or RS485 connection.

The VSC Base Station module shall accept input power of either 15-30 VDC or 12-24 VAC and shall be fuse protected. The VSU and VSC modules shall be capable of acting as a repeater to store and forward information from one module to another module to facilitate communication around obstacles or extending coverage area. Designating a module as a repeater shall be through software configuration and shall not require additional hardware.

Radio signal strength testing shall be accomplished with two radio modules and a laptop computer. One unit shall be the transmitter and the receiver unit shall be connected to the PC for monitoring and recording signal strength. No additional hardware shall be required other than antennas and cable.

The Cla-Val VSU/VSS/VSC modules shall be DIN rail mountable and have removable terminal strips for simplified wiring. Operating conditions shall be within -20 to 140 degrees F and 0 to 99% relative humidity.



E-VSU

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