

# **Eltav Wireless Monitoring System**

## **Installation and Operation Manual**

### **T/VDR**

Part No. VDY 23011

Revision 2.6

March 2014

## Introduction



### WARNING!

Misuse of this equipment can cause bodily harm. Operations not performed as per the instructions in this document are undertaken entirely at the user's own risk and liability.

Une mauvaise utilisation de cet équipement peut causer des lésions corporelles. L'utilisateur qui ne respecte pas les directives figurant dans le présent document est entièrement responsable des risques auxquels il s'expose.



### WARNING!

To prevent bodily harm or damage to equipment, only trained, authorized personnel should install, maintain and repair the equipment.

Pour éviter les lésions corporelles ou les dommages à l'équipement, seul un personnel formé et autorisé doit installer, entretenir et réparer l'équipement.



### WARNING!

This equipment has been tested and certified as being non-sparking. Please note that severe restrictions apply to this equipment in regard to its construction, installation, external wiring, maintenance and repair. Failure to abide by these restrictions could make the equipment a hazard to operate.

Ce matériel a été testé et certifié comme ne produisant pas d'étincelles. Veuillez noter que des restrictions importantes s'appliquent à ce matériel au niveau de sa construction, de son installation, de son câblage externe, de sa maintenance et de sa réparation. Le non-respect de ces restrictions pourrait entraîner des risques lors de l'utilisation.



### CAUTION

To prevent damage to equipment through electrostatic charge on plastic surface of the VD / TVDR, always wipe the surface with a damp cloth.

Pour éviter les dommages à l'équipement causés par la charge électrostatique présente sur la surface de plastique du dispositif de contrôle de soupapes, essuyez toujours la surface avec un chiffon humide.

## Introduction



### CAUTION

The installation of the equipment should be carried out by appropriately trained and qualified professional personnel with relevant expertise. The installation should not be carried out by operators or non-qualified personnel.

L'installation du matériel doit être réalisée exclusivement par du personnel professionnel compétent correctement formé et disposant de l'expertise nécessaire. L'installation ne peut être réalisée par des opérateurs ou du personnel non qualifié.



### CAUTION

The installation should be carried out in accordance with the local electric code.

L'installation doit être réalisée conformément à la réglementation électrique locale.



### CAUTION

Make sure that the circuit breakers installed in the power supply circuits are located in the non-hazardous areas and the power can be shut-off when abnormal conditions occur.

Veillez à ce que les disjoncteurs installés dans les circuits d'alimentation soient situés dans les zones non dangereuses et veillez à ce que l'alimentation puisse être coupée en cas de problème.



### CAUTION

In order to prevent electrostatic charge, avoid any actions that cause the generation of electrostatic fields, such as rubbing with dry cloth on face of the equipment.

Pour éviter toute charge électrostatique, évitez toute action qui pourrait entraîner la production de champs électrostatiques comme tout frottement avec des tissus secs contre la partie avant de l'équipement.



### CAUTION

This equipment cannot be opened in a hazardous area. Connect and disconnect the DC line and the data line before installation or disassembly or maintenance.

Cet équipement ne peut être ouvert dans une zone dangereuse. Branchez et débranchez la ligne CC et la ligne de données avant l'installation, le démontage ou la maintenance.

## Introduction



In order to prevent ingress of water and dust, always make sure that enclosure is dry and clean before opening the cover.

Pour éviter toute infiltration d'eau et de poussière, veillez toujours à ce que le boîtier soit sec et propre avant d'ouvrir le couvercle.



Always apply suitable rated devices to the electrical connection ports.

Utilisez toujours les appareils de tension correcte lors du branchement aux ports de connexion électrique.



Connector J5 contains a protective PTC component. Do not replace with an ordinary jumper.

Le connecteur J5 contient un composant PTC protecteur. Ne pas le remplacer par un connecteur ordinaire.



Carefully read the safety information contained in this section, and throughout this user guide, before installing, operating, or performing any maintenance task on the equipment.

Lisez attentivement les consignes de sécurité contenues dans cette section et dans tout le guide d'utilisation, avant d'installer, d'utiliser l'équipement ou de réaliser des tâches d'entretien.



This power supply should be in a safe area unless it has been approved for hazardous locations.

Cette alimentation doit se situer dans une zone sûre sauf si elle a été approuvé pour des emplacements dangereux.

## Introduction

 FCC ID: X2VVDR000XX

This device complies with part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

IC: Industry Canada 8876A-VDR000XX

Operation is subject to the following two conditions:

- (1) This device may not cause interference, and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device

 ID FCC : X2VVDR000XX

Ce dispositif est conforme à la section 15 des réglementations de la FCC.

Cet appareil est soumis aux deux conditions suivantes :

- (1) cet appareil ne doit pas causer d'interférences nuisibles et
- (2) doit accepter toute interférence reçue, y compris les interférences pouvant entraîner un fonctionnement indésirable

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Cet appareil est soumis aux deux conditions suivantes :

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## Introduction

### Revision History

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1.1	07/2007	Israel Kalman	First Draft
1.2	08/2007	Israel Kalman	Following internal review
1.3	09/2008	Israel Kalman	Updated Draft
1.4	01/2009	Israel Kalman	Updated ODLite gen 1
1.5	01/2009	Israel Kalman	Following internal review
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1.7	03/2009	Israel Kalman	New OD added
1.8	05/2009	Israel Kalman	EMS Update
2.0	12/2010	Ohad Gal	Major revisions following system update
2.1	01/2011	Ohad Gal	EMS Update
2.2	04/2011	Ohad Gal	Product Updates
2.3	07/2011	Ohad Gal	Product Updates
2.4	08/2012	Ohad Gal	Product Updates
2.5	11/2013	Raphael Yakubov	Product Updates
2.6	03/2014	Raphael Yakubov	FCC/IC clauses

### Warranty

Eltav warrants that the Eltav Wireless Monitoring System is free of defective materials and faulty workmanship. If warranted goods are returned to Eltav during the period of coverage, Eltav will repair or replace, at its option, without charge, those items it finds defective. The foregoing is the buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Eltav be liable for consequential, special, or indirect damages.

## Introduction

### TABLE OF CONTENTS

<b>1</b>	<b>Introduction.....</b>	<b>8</b>
1.1	Scope of Manual .....	8
1.2	Abbreviations, Acronyms and Terms .....	8
1.3	System Principles of Operation.....	8
1.3.1	Introduction.....	8
1.3.2	Valve Device (VD) .....	9
1.3.3	Discrete Input Device (DIB).....	10
1.3.4	Valve Device Router (VDR) .....	10
1.3.5	Tunneling Valve Device Router (TVDR) .....	10
1.3.6	EMS Server .....	11
1.3.7	EMS Clients .....	11
1.3.8	PLC Adapter.....	11
1.3.9	Operator Device.....	11
1.3.10	Eltav Management System .....	11
1.3.11	Eltav Starter Kit .....	12
1.4	System Specifications.....	13
<b>4</b>	<b>Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR) .....</b>	<b>14</b>
4.1	Valve Device Router/Tunneling Valve Device Router Overview.....	14
4.1.1	Front Panel Indicators.....	15
4.2	T/VDR Specifications .....	16
4.3	Installation .....	18
4.4	Configuration.....	23
4.5	PCB Layout.....	23
4.6	Terminal Connection .....	24
4.7	Powering Up and Shutting Down the T/VDR .....	26
4.8	Connecting a TVDR.....	27
4.8.1	Overview .....	27
4.8.2	Connecting a TVDR for USB Connection .....	27
4.8.3	Configuring a TVDR for TCP/IP Connection .....	28
4.8.4	EMS Infrastructure Configuration Utility .....	29
4.9	Troubleshooting .....	31
4.9.1	T/VDR does not power on .....	31
4.9.2	T/VDR does not join the wireless network .....	32
4.9.3	VDR is not displayed in EMS but the NET LED is lit.....	32
4.9.4	TVDR does not go online .....	32
4.9.5	Reception is poor .....	32
4.9.6	LINK indication is not lit (for TCP/IP connection only) .....	33
4.9.7	NO BAT LED is lit .....	33
4.9.8	Cannot connect to the device during a TELNET session .....	33
4.9.9	Cannot find the device in the configuration utility (Infrastructure Config) .....	34
4.9.10	Cannot configure the device in the configuration utility (Infrastructure Config) .....	34
4.9.11	TCP/IP connection with the device is not stable.....	34

# 1 Introduction

This chapter provides an overview of the Eltav Wireless Monitoring System, including:

- ✓ Abbreviations, Acronyms and Terms
- ✓ Certification and Approvals
- ✓ Principles of Operation
- ✓ General Specifications

## 1.1 Scope of Manual

This manual includes principles of operation, specifications, installation, setup, configuration, operation, troubleshooting, and maintenance information for the Eltav Wireless Monitoring System.

## 1.2 Abbreviations, Acronyms and Terms

- ACK – Acknowledgement Message
- DIB – Discrete Input Box
- Eltav Gateway – An industrial computer running the EMS
- EMS – Eltav Management System
- EUI – Extended Unique Identifier
- HMI – Human Machine Interface
- OD – Operator Device
- OPC – OLE for Process Control
- PLC – Programmable Logic Controller
- PLCA – PLC Adapter
- SCADA – Supervisory Control and Data Acquisition
- TVDR – Tunneling Valve Device Router
- VD – Valve Device
- VDR – Valve Device Router

## 1.3 System Principles of Operation

### 1.3.1 Introduction

Eltav Wireless Monitoring Ltd. has developed an innovative concept of monitoring valves in the process automation world using the most advanced, safe and reliable wireless technologies. The Eltav wireless sensor system revolutionizes industrial processing, enabling real-time data sharing throughout a facility to increase industrial efficiency and productivity. Moreover, Eltav's wireless sensor technology offers reliable, autonomous process control to improve product quality, increase yield, and reduce costs.

The Eltav Wireless Valve Monitoring System provides real-time information about the status of valves installed in process plants. The data is fed directly into the customer's control system, thereby reducing failure while increasing safety and yield. The Eltav System is based on the

## Introduction

ZigBee Pro standard protocol and serves as an add-on layer over traditional process management systems, providing enhanced monitoring capabilities with considerably reduced complexity. The Eltav system includes support for a wide range of standard interfaces, physical and logical, that are common in the industry. This makes the Eltav system, from the perspective of connectivity, almost transparent for system designers and integrators, since they can easily integrate the Eltav system into any of the most widely-used system architectures in the process industry.

The Eltav Wireless Valve Monitoring System has the following main functionalities:

- **Manual Valve Operation Monitoring:** Many process valves are activated manually by field operators who receive instructions from the control room. Such manual processes are vulnerable to human error and can result in substantial damage and poor yield. The Eltav system provides the plant with an efficient, cost-effective solution to monitor installed devices.
- **Actuated Valve Operation Monitoring:** Although actuated process valves are activated remotely, many do not have any feedback on the operation and, in cases of actuation failure, a false valve position may be reported. The Eltav solution complements the actuated operation with full monitoring feedback.
- **Actuated Valve Maintenance:** Wear and tear of actuated valves can result in a broken shaft (causing an excessively fast response), or in shaft deterioration that slows down the valve's movement. The dynamic profile of actuated valves during transactions must consistently remain within a pre-set range. Whenever these limits are breached, an alarm is generated.
- **Partial Stroke Monitoring:** Static valves that remain in the same position for long periods of time may lose their operational flexibility. To facilitate periodic "instruction" of such a valve to move, the Partial Stroke Test (PST) is initiated, either by the control system or manually. Valve position monitoring allows PSTs to be recorded and stored for audit and evidence.

### 1.3.2 Valve Device (VD)



An Eltav Valve Device (VD) is bracket-mounted to any type of valve or actuator and – using the standard wireless 802.15.4/ZigBee Pro, 2.4 GHz protocol – wirelessly transmits and receives messages relevant to the position status of the valve in real time.

The VD is powered by two half-AA Lithium batteries. In nominal operation, the battery life of the VD is above 5 years. A battery pack can be replaced in the field.

The VD includes a shaft that is fastened to the valve's stem through a special cylinder. It transfers the angle position of the stem to the VD. An internal VD sensor measures the circular position of the VD shaft, thus providing information about the angular position of the stem in degrees relative to the valve.

The VD reports the valve position (angle) immediately when motion of the valve lever is sensed or for every predefined period (configurable). The VD temperature, VD battery status, and other VD keep-alive information are broadcast with every VD message. Each VD message is

## Introduction

transmitted with a real-time stamp. In between transmissions the VD is in dormant status in order to save battery power.

The VD also consists of a Low-Frequency (LF) receiver for receiving setting commands from the Operator Device and to commission, decommission, calibrate, and set up the unit and to perform diagnostic procedures.

### 1.3.3 Discrete Input Device (DIB)



The Eltav Discrete Input Box (DIB) consists of a standard wireless 802.15.4/ZigBee Pro, 2.4 GHz protocol which wirelessly transmits and receives messages relevant to the state of the input in real time. It has 2 or 4 digital dry contact inputs and one analog input (future option). The DIB is a non-routing device, operating in sleep mode, that reports input states at configurable intervals (from every 8 seconds to every 60 minutes) or immediately after it senses a state change in one of the inputs. The DIB temperature, battery status, the state of the digital inputs, wireless signal strength, and other housekeeping information are broadcasted with every message. Each DIB message is transmitted with a real-time stamp.

### 1.3.4 Valve Device Router (VDR)



Each VDR collects and routes data from nearby VDRs and up to 32 associated VDs, and transmits the information towards the control center by hops from VDR to VDR.

The VDR acts as a relay that retransmits the messages received from a remote VDR, through the ZigBee wireless network, until they reach a TVDR (see below for details). Data transfer redundancy is ensured by automatic routing of the wireless devices through a mesh topology and providing multiple TVDRs for each wireless network.

### 1.3.5 Tunneling Valve Device Router (TVDR)

The Tunneling Valve Device Router (TVDR) is the last-hop VDR that transfers collected data from VDRs to the Eltav Gateway. Several TVDRs can be connected, via TCP/IP, to the Eltav Gateway (thus ensuring full redundancy and avoiding a single-point of failure).

## Introduction

### 1.3.6 EMS Server

The EMS Server is the central software server on the TCP/IP network. It maintains the wireless network, performs data logging, and publishes sensor information to clients and to the customers' monitoring and control systems (PLC, SCADA, etc.)

### 1.3.7 EMS Clients

- **GUI Client:** Provides a view of sensor data and network status and allows configuration of remote sensors and alarms.
- **Connectivity Client:** Forwards Valve Device data and status to the third-party PLC, DCS and SCADA. Supported protocols are MODBUS RTU, MODBUS TCP/IP and OPC DA.
- **Connectivity Service:** Similar to the Connectivity Client, the Connectivity Service also forwards Valve Device data and status to the third-party PLC, DCS and SCADA. Supported protocols are MODBUS RTU, MODBUS TCP/IP and OPC DA. The connectivity service runs as a windows service and loads automatically after every system reboot. The service runs in the background and does not require any user involvement or maintainability.

### 1.3.8 PLC Adapter

The PLC Adapter (PLCA) is a hardened connectivity device that supplies real-time data to PLCs/HMIs that reside on a plant's dedicated network. The PLCA transfers relevant data from the Eltav Network and transfers it via MODBUS RTU and/or MODBUS TCP/IP, in real time, to PLCs/HMIs. The PLCA is seamlessly situated on the Eltav Network between the EMS and TVDRs and extracts the requested device information from the data stream. From this position in the Eltav Network, the PLCA also acts as a redundant network manager – keeping the Eltav Network alive in case of Gateway unavailability for any reason.

### 1.3.9 Operator Device

The Operator Device (OD) is a hand-held device that enables the field operator to communicate with a selected field device (VD/VDR/TVDR) using low-frequency transmissions and ZigBee. Such one-on-one communication provides the field operator with a transportable and effective control panel to independently perform various operation and maintenance tasks. The OD delivers messages to operators, reports on performance, and is used to support installations, configuration, provisioning, and maintenance.

### 1.3.10 Eltav Management System

The Eltav Management System (EMS) processes collected data, monitors it, and delivers it to various typical clients at the process control management system. Such clients are located in various levels of the process control – from the high-level HMI and down to the line controllers (PLCs). The Eltav Management System supports such typical clients and data/indication and uses generic interface converters to provide the required interface accordingly.

## Introduction

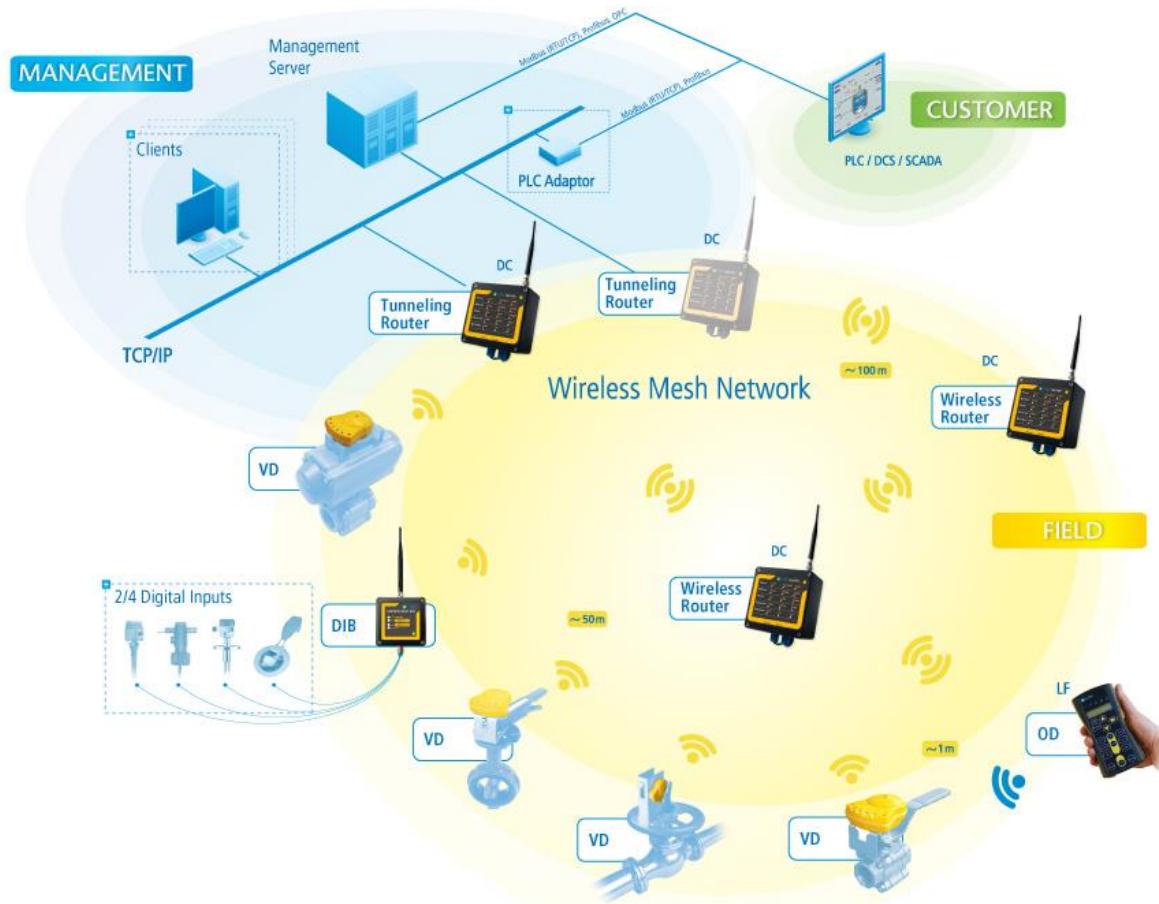


Figure 1: Eltav Wireless Monitoring System – Block Diagram

### 1.3.11 Eltav Starter Kit



The Eltav Starter Kit is composed of the actual components of the Eltav Wireless Valve Monitoring System. The kit provides integrators, instrumentation experts, and other interested parties with the ability to build, test, evaluate, and demonstrate the Eltav Wireless Valve Monitoring System in a real operational environment. The Eltav Starter Kit is also ideal for training field engineers and operators.

## Introduction

The Eltav Starter Kit consists of two valve devices (VDs) – the first is installed on a 1-inch manual valve and the second is installed on a valve simulator; a Tunneling Valve Device Router (TVDR); an Operator Device (OD), and the Eltav Management System Standalone version (EMS Lite). All required cables and accessories are also included.

## 1.4 System Specifications

The following table provides general system specifications.

**Table 1: General Specifications**

Function	Explanation
Wireless Communication	Two-way Radio – IEEE 802.15.4 – at 2.4 GHz.
Communication Protocol	ZigBee Pro version
Security	AES 128-bit encryption
Message Hops	Up to 15 hops from VD to VDR to VDR till it reaches a TVDR
Approach	Angle measurement of valve stem position.
Update Rate	The VD transmits its status immediately when the valve moves more than 1.50 degrees, or at every predefined period (configurable).
Latency	Less than 0.1 sec on average (assuming one hop)
Interface to Existing Process Control Systems	The Eltav Gateway is designed to deliver data collected from the process line to any typical client or format commonly used in the traditional process control lines. This starts with OPC for the HMI / SCADA systems and down to the valve status report fed directly to the PLC in the line, using the popular MODBUS protocol.
Operating Temperature	-40 <sup>0</sup> C to 80 <sup>0</sup> C (VD)
	-40 <sup>0</sup> C to 80 <sup>0</sup> C (VDR)
	-40 <sup>0</sup> C to 70 <sup>0</sup> C (TVDR)
VD/VDR/TVDR sealing	IP65 grade
ATEX Certification	VD: Zone 1, II 2 GD x ia IIC T4 Ga Ex ia IIC T135 Da T/VDR: Zone 2, II 3 G Ex nA IIC T4
System Commissioning	With short-range low-frequency signal (LF) at 125KHz by the Operator Device. Encryption password is also delivered in this manner.

## **2 Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)**

**This chapter provides an overview of the Eltav Valve Device Router (VDR) and Tunneling Valve Device Router (TVDR) including:**

- ✓ **Operation**
- ✓ **Installation**
- ✓ **Specifications**
- ✓ **Configuration**
- ✓ **Troubleshooting**

### **2.1 Valve Device Router/Tunneling Valve Device Router Overview**



**Figure 2: T/VDR**

The VDR collects and routes data from nearby VDRs and up to 32 directly associated VDs and transmits the information to the control center. The VDR acts as a relay that retransmits the messages received from remote VDRs, through the ZigBee wireless network, until they reach a TVDR. Data transfer redundancy is assured by automatic routing of the wireless devices through a mesh topology.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

The Tunneling Valve Device Router (TVDR) is the last-hop VDR that transfers collected data from VDRs to the Eltav Gateway. Several TVDRs can be connected, via TCP/IP, to the Eltav Gateway (thus ensuring full redundancy and avoiding a single point of failure).

A TVDR acts as a tunneling valve device router only when it is connected to the EMS or PLCA, namely, only when it can convey messages from the wireless domain to the control center. When this is not the case, the device reduces its functionality to a VDR. When the connection to the EMS or PLCA is reestablished, the device will automatically change back to a TVDR and advertise this change within the wireless network.

The notation **TVDR** is used in conjunction with a device that is correctly able to convey messages from the wireless network to the EMS or PLCA. We use the notation **VDR** for any other case, regardless of the physical difference between the two.

The notation **T/VDR** is used when the text is relevant for both scenarios.

### 2.1.1 Front Panel Indicators

The following illustration and table present the front indicators.

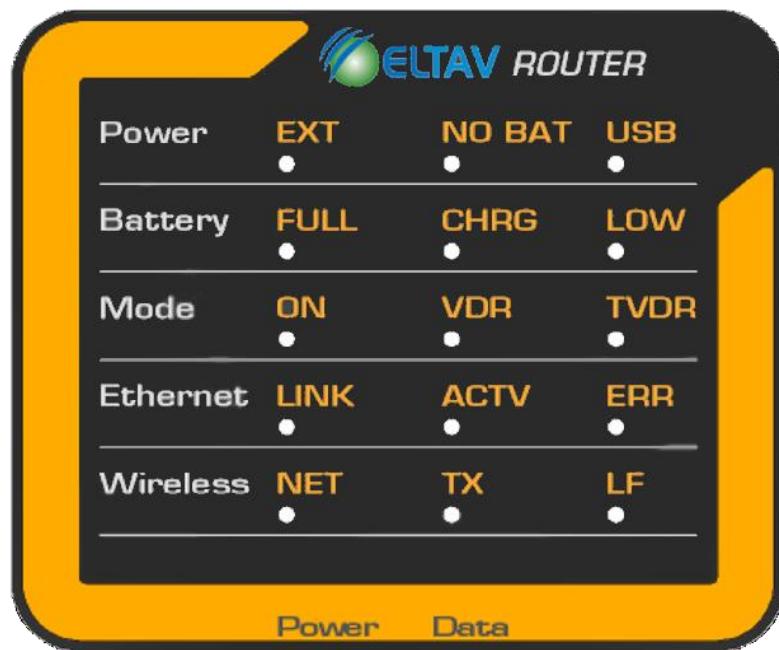


Figure 3: T/VDR Front Panel

Table 2: T/VDR Front Panel Indicators

Feature	Explanation
Power	<ul style="list-style-type: none"><li><b>EXT:</b> External power supply is connected</li><li><b>NO BAT:</b> Battery is disconnected (J5 jumper)</li><li><b>USB:</b> Power is supplied via USB connection</li></ul>
Battery	<ul style="list-style-type: none"><li><b>FULL:</b> Battery is full</li><li><b>CHRG:</b> Battery is charging</li><li><b>LOW:</b> Battery is low</li></ul> <p>If the T/VDR battery has been completely depleted, the</p>

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

Feature	Explanation
	<p>charging sequence is as follows:</p> <ul style="list-style-type: none"> <li>• It starts with all three LEDs lighting together.</li> <li>• When it reaches 3 V, the pre-charge sequence is compete and this is indicated by the <b>CHRG</b> LED blinking.</li> <li>• The <b>LOW</b> LED extinguishes when the charging level reaches 3.2 V.</li> <li>• Upon full charge, the <b>FULL</b> LED lights constantly.</li> </ul>
Mode	<ul style="list-style-type: none"> <li>• <b>ON:</b> Device is powered and operational</li> <li>• <b>VDR:</b> Device is in VDR mode</li> <li>• <b>TVDR:</b> Device is in TVDR mode</li> </ul> <p> <b>NOTE</b> VDR and TVDR modes are mutually exclusive.</p>
Ethernet	<ul style="list-style-type: none"> <li>• <b>LINK:</b> TCP/IP link is connected</li> <li>• <b>ACTV:</b> Activity on the TCP/IP link</li> <li>• <b>ERR:</b> Error condition on the TCP/IP link</li> </ul>
Wireless	<ul style="list-style-type: none"> <li>• <b>NET:</b> Device is connected to the wireless (ZigBee) network</li> <li>• <b>TX:</b> Device is transmitting (in the ZigBee network)</li> <li>• <b>LF:</b> Device is receiving a Low Frequency signal</li> </ul>

## 2.2 T/VDR Specifications

The specifications for the VDR and TVDR are provided in the following table.

**Table 3: VDR and TVDR Specifications**

Feature	Explanation
Network architecture	VDRs and TVDRs provide a full self-recovery, self-healing mesh architecture using ZigBee PRO protocol.
VDR/TVDR max transmitted power	+18 dBm (+ additional antenna gain)
Antenna	External, 20 cm, +3dBi with male N-type connector. At challenging installations, higher gain antennas can be used.
VDs per VDR	32
VDRs per network	500
TVDR	From ZigBee PRO domain to Ethernet TCP/IP and back. Transfer of data with Gateway.
VDR	From ZigBee Pro to ZigBee Pro domains; VD range extender

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

Feature	Explanation
TVDRs per network	50
TVDR connection	<ul style="list-style-type: none"> <li>Two Glands Power and Data</li> <li>3-pin terminal block for DC</li> <li>5-pin terminal block for Ethernet</li> <li>5-pin terminal block for USB</li> </ul>
VDR connection	<ul style="list-style-type: none"> <li>One Gland Power</li> <li>3-pin terminal block for DC</li> </ul>
Control	Internal jumper and/or LF command from OD
Indications	15 colored LEDs on Front Panel
Mounting	On wall by special installation brackets
Communication range router-to-router	Open space: about 200m Indoors, in non-obstructed environment: about 100 m
Backup power supply (in applicable models)	<ul style="list-style-type: none"> <li>2.2 AH Li-Ion rechargeable battery</li> <li>VDR standby: 12 hours</li> <li>TVDR standby: 4 hours</li> <li>Battery charged when unit is DC-powered (also in OFF)</li> </ul>
DC power supply	<ul style="list-style-type: none"> <li>VDR: 7-36 V / 10W max.</li> <li>TVDR: 7-36 V / 10W max.</li> </ul>
Operating Temperature	<p><b>Without Battery</b></p> <ul style="list-style-type: none"> <li>VDR: -40<sup>0</sup>C to 80<sup>0</sup>C</li> <li>TVDR: -40<sup>0</sup>C to 70<sup>0</sup>C</li> </ul> <p><b>With Battery</b></p> <ul style="list-style-type: none"> <li>VDR: -20<sup>0</sup>C to 40<sup>0</sup>C</li> <li>TVDR: -20<sup>0</sup>C to 40<sup>0</sup>C</li> </ul>
FCC/IC	FCCX2VVDR000XX/IC8876A-VDR00044
ATEX	CE Ex II 3 G Ex nA IIC T4 NEC 500-Class I, Division 2, Groups A&B T4; NEC 505: Class I, Zone 2, AEx n, IIC T4



To avoid exceeding the maximum operational temperatures, we recommend, in hot and sunny environments, that the device be positioned in a shady location away from direct sunlight.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)



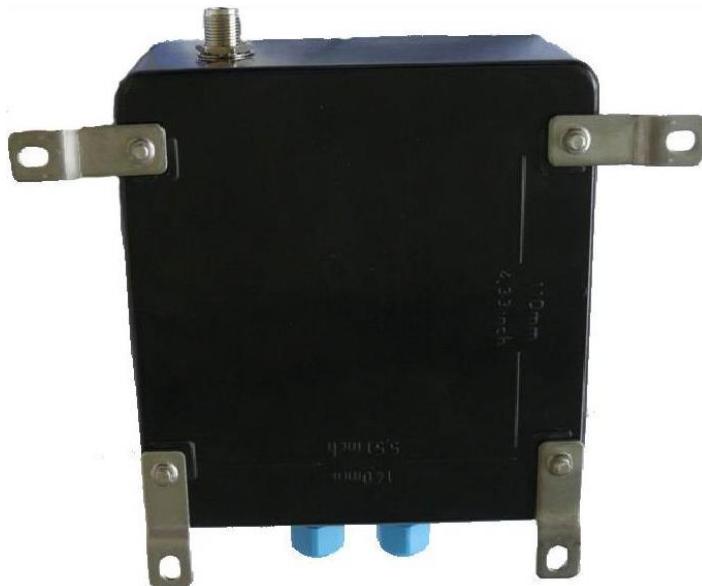
This equipment has been tested and certified as being non-sparking. Please note that severe restrictions apply to this equipment in regard to its construction, installation, external wiring, maintenance and repair. Failure to abide by these restrictions could make the equipment a hazard to operate.

Ce matériel a été testé et certifié comme ne produisant pas d'étincelles. Veuillez noter que des restrictions importantes s'appliquent à ce matériel au niveau de sa construction, de son installation, de son câblage externe, de sa maintenance et de sa réparation. Le non-respect de ces restrictions pourrait entraîner des risques lors de l'utilisation.



This apparatus is suitable for use in Class I, Division 2, Groups A, B, C, and D, T4 or equipment Group Category 3, Zone 2, Group IIC, Temperature classification T4 (135°C).

### 2.3 Installation



**Figure 4: Rear of T/VDR with Mounting Brackets in Vertical and Horizontal Positions**

To assemble the T/VDR, perform the following steps:

1. Position the T/VDR in an area suitable for transmission such that the antenna is fully exposed.
2. Ensure that the T/VDR antenna is positioned at least 37.5cm away from any large metallic surface.
3. Using four screws, mount the T/VDR on a flat surface.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

4. Connect T/VDR terminals as shown in Figure 5. Pay particular attention to the separation between Safe and Hazardous areas. For additional information, refer to the discussion on terminal connections in Section 2.6

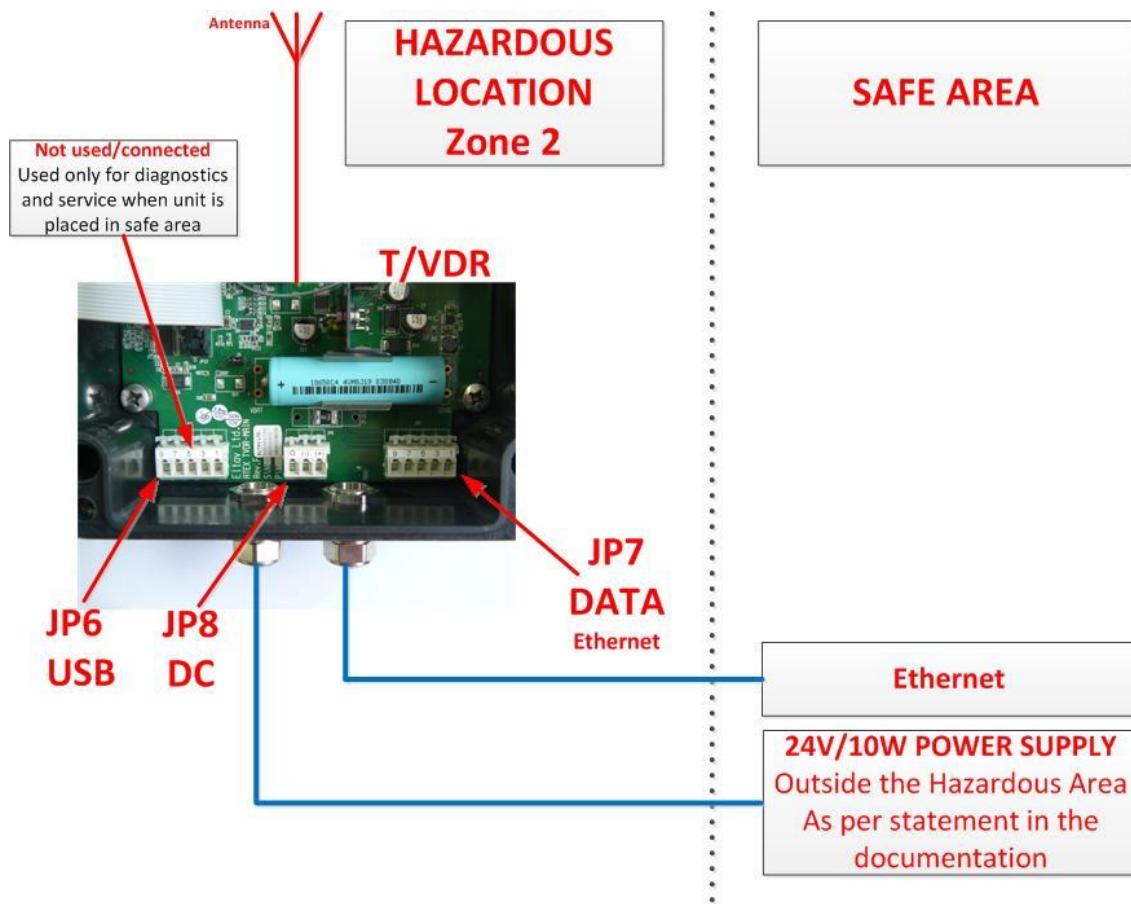


Figure 5: T/VDR Terminal Connections, Showing Safe and Hazardous Areas

**NOTE**  
Under Industry Canada regulations, the TVDR/VDR radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (E.I.R.P.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, l'émetteur radio TVDR / VDR ne peut fonctionner qu'à l'aide d'une antenne d'un type et un maximum (ou moins) gain approuvé pour l'émetteur par Industrie Canada. Afin de réduire le risque d'interférence aux autres utilisateurs, le type d'antenne et son gain doivent être choisis afin que la puissance équivalente (PRIE) isotrope rayonnée ne dépasse pas ce qui est nécessaire pour une communication réussie.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)



This radio transmitter of the TVDR/VDR has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

P/N ANT00011 Outdoors Collinear Omnidirectional, Vertical Polarization, 50ohm and with +3dbi gain, N-type (M).

Cet émetteur radio de la TVDR / VDR a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous avec le gain maximal admissible et l'impédance d'antenne requise pour chaque type d'antenne indiqué. Les types d'antennes que ne figurent pas dans cette liste, ayant un gain supérieur au gain maximum indiqué pour ce type, sont strictement interdits pour une utilisation avec cet appareil.

P/N ANT00011 extérieur colinéaire omnidirectionnelle, polarisation verticale, 50ohm et avec un gain de 3 dBi, de type N (M).



The brackets can be positioned for horizontal or vertical mounting.



The installation of the equipment should be carried out by appropriately trained and qualified professional personnel with relevant expertise. The installation should not be carried out by operators or non-qualified personnel.

L'installation du matériel doit être réalisée exclusivement par du personnel professionnel compétent correctement formé et disposant de l'expertise nécessaire. L'installation ne peut être réalisée par des opérateurs ou du personnel non qualifié.



The installation should be carried out in accordance with the local electric code.

L'installation doit être réalisée conformément à la réglementation électrique locale.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)



### CAUTION

Make sure that the circuit breakers installed in the power supply circuits are located in the non-hazardous areas and the power can be shut-off when abnormal conditions occur.

Veillez à ce que les disjoncteurs installés dans les circuits d'alimentation soient situés dans les zones non dangereuses et veillez à ce que l'alimentation puisse être coupée en cas de problème.



### IMPORTANT

This power supply should be in safe area unless it has been approved for hazardous locations.

Cette alimentation doit se situer dans une zone sûre sauf si elle a été approuvé pour des emplacements dangereux.



### CAUTION

In order to prevent electrostatic charge, avoid any actions that cause the generation of electrostatic fields, such as rubbing with dry cloth on face of the equipment.

Pour éviter toute charge électrostatique, évitez toute action qui pourrait entraîner la production de champs électrostatiques comme tout frottement avec des tissus secs contre la partie avant de l'équipement.



### CAUTION

This equipment cannot be opened in a hazardous area. Connect and disconnect the DC line and the data line before installation or disassembly or maintenance.

Cet équipement ne peut être ouvert dans une zone dangereuse. Branchez et débranchez la ligne CC et la ligne de données avant l'installation, le démontage ou la maintenance.



### CAUTION

In order to prevent ingress of water and dust, always make sure that enclosure is dry and clean before opening the cover.

Pour éviter toute infiltration d'eau et de poussière, veillez toujours à ce que le boîtier soit sec et propre avant d'ouvrir le couvercle.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)



Always apply suitable rated devices to the electrical connection ports.

Utilisez toujours les appareils de tension correcte lors du branchement aux ports de connexion électrique.



Explosion hazard. Do not disconnect while the circuit is live or unless the area is known to be free of concentrations of flammable materials.

Risque d'explosion. ne débranchez pas l'équipement tant que le circuit est sous tension, sauf si la zone est exempte de matières inflammables.



Do not open the device enclosure in a hazardous area.

N'ouvrez pas le boîtier de l'appareil dans une zone dangereuse.



Electrostatic hazard – clean only using a damp cloth.

Risque électrostatique – nettoyez uniquement à l'aide d'un chiffon humide.



Explosion Hazard – Substitution of components may impair suitability for Class I, Division 2.

Risque d'explosion – la substitution des composants peut rendre cet équipement inapproprié pour la Classe I, Division 2.



In order to protect the appliance, the LAN system and the associated power supply against transient voltages caused by lighting strikes, this product must have a suitably approved protective device situated between an external outdoor antenna and the product; the protective device must meet the requirements of the standard IEC 60950-1 clause 7.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

Afin de protéger l'appareil, le système LAN et l'alimentation électrique associée contre les tensions transitoires causées par la foudre, ce produit doit comporter un dispositif de protection approuvé, placé entre une antenne extérieure et le produit ; le dispositif de protection doit répondre aux exigences de la norme CEI 60950-1, article 7.

## 2.4 Configuration

Configuration of the T/VDR is discussed in Chapter 2.9.12. The following items must be configured:

- **Router Tag:** Given Tag of the T/VDR that identifies the router according to the user's internal policy
- **Network Heartbeat Timeout:** Period before network is shut down. This is configurable and set in accordance with the power reliability on the line.
- **TX Interval:** Interval at which the T/VDR sends status messages.
- **TX Power:** The transmit power level (in dBm units).
- **Network Name:** The Network name is set during network configuration and this prevents potential conflict when two networks are in close proximity and obviates the possibility of a confused T/VDR - VD association.
- **Group ID:** Up to 120 connectivity groups can be defined. VDs and VDRs can be grouped on a logical basis according to process lines. TVDRs will forward messages pertaining only to their connectivity group.
- **Channel Mask:** A channel can be blacklisted so that it will not be used.



Configuration of the T/VDR can be performed once the T/VDR is powered and operational (**ON** LED lights constantly). When configuration is performed from the EMS, the T/VDR must also be connected to the wireless network and appear as **ONLINE** in the EMS.

## 2.5 PCB Layout

The TVDR has a number of sockets and jumpers, as schematically shown in Figure 6, which are listed herein:

- JP2 – 30-pin socket for external I/O card (extension card purchased separately)
- JP5 – Disconnect Battery Jumper
- JP6 – USB terminal
- JP7 – Ethernet terminal
- JP8 – DC power terminal
- JP12 – 20-pin socket for upper panel cable
- JP13 – JTAG programming header

The following elements were added in Rev G (displayed by dashed lines in Figure 6):

- J6 – Disconnect external power supply
- JP14 – RS45 Ethernet connection port

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

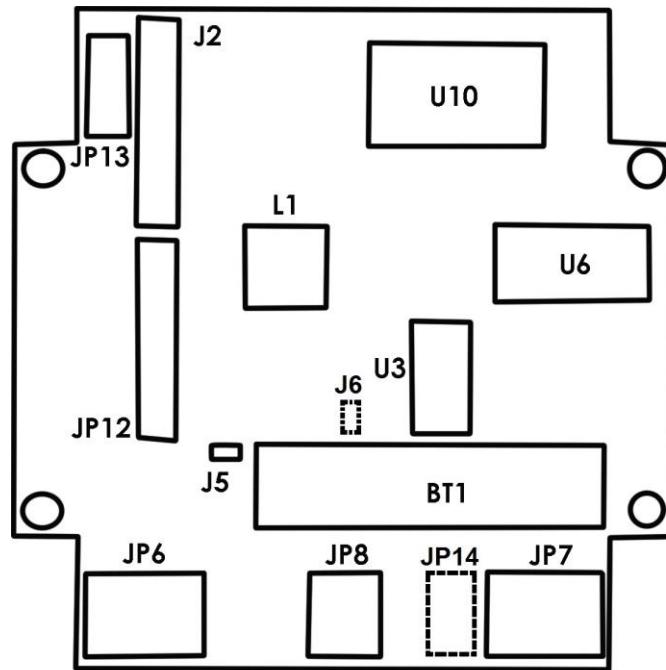


Figure 6: Layout of TVDR

### 2.6 Terminal Connection

The following information is relevant to the T/VDR terminal connection.

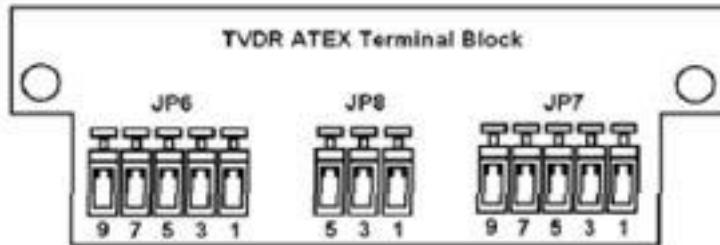


Figure 7: TVDR Terminal Connection

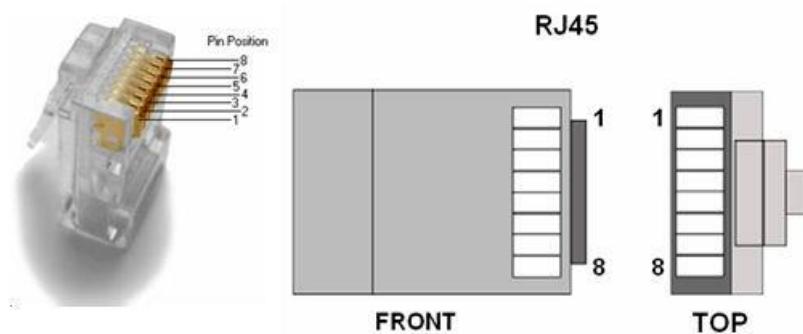
## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

**Table 4: DC Power Cable**

DC Power Cable	JP8	Binder 99-0429-14-04 Male Eltav PN CON50012 (optional)
Red wire (+7–36 V DC)	1	1
Black wire (common)	3	4
Ground: Earth	5	-

**Table 5: LAN Cable**

Color T568A	Color T568B (Europe)	RJ45 Conn.	JP7
Green-white	Orange-white	1	1
Green	Orange	2	3
Orange-white	Green-white	3	5
Blue	Blue	4	-
Blue-white	Blue-white	5	-
Orange	Green	6	7
Brown-white	Brown-white	7	-
Brown	Brown	8	-



**Figure 8: LAN Cable**

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

Table 6: USB Cable

Color	Signal	JP6	USB A Male Conn. (optional)
Red	USB-	1	1
White	DATA-	3	2
Green	DATA+	5	3
Black	USB-	7	4
NA	GND	9	-

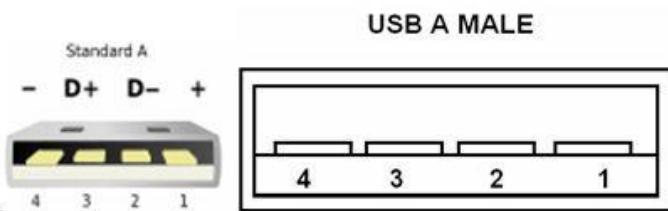


Figure 9: USB Cable

### 2.7 Powering Up and Shutting Down the T/VDR

The T/VDR is delivered in a shut-down state. While in this state, the wireless radio is shut down, and the device is ready to receive the LF command to power up and join a wireless ZigBee network. To power up and join the T/VDR to a wireless network, use the OD as described in Section Error! Reference source not found., and send the **JOIN** (or **JOIN ALL**) command to the T/VDR.



Jumper J5 disconnects the battery from the circuit, causing the device to work only on external power. Before powering up the T/VDR, make sure that the device is connected to external power and/or J5 is connected.



Connector J5 contains a protective PTC component. Do not replace with an ordinary jumper.

Le connecteur J5 contient un composant PTC protecteur. Ne pas le remplacer par un connecteur ordinaire.

When the T/VDR powers up to operational mode, the NET LED flashes a few times and then the ON LED constantly lights. Once powered up, the T/VDR automatically joins the network to which the OD is joined. If the network does not exist (or the OD is not joined to a network) the T/VDR looks for any other ZigBee Pro network that conforms to the configuration (that the OD

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

passes through). If no such network exists, the VDR keeps trying to join the same network at longer intervals until the network is found / formed or until the VDR is shut down. On the other hand, the TVDR will form a new network if the desired one is not found within a few attempts.

When joined to the wireless network, the T/VDR will send an acknowledgement to the OD.

To shut down the T/VDR, use the OD, as described in Section Error! Reference source not found., and send the **LEAVE** (or **LEAVE ALL**) command. Once the T/VDR receives the **LEAVE** command, the NET LED flashes a few times, the T/VDR sends an acknowledgement to the OD, and then shuts down. When the T/VDR is shutdown, the ON LED is turned off.

The EMS and PLCA are aware of these events and should reflect the change in the T/VDR state. When the T/VDR powers up and joins the network, it is also displayed in the EMS tabular display (if not already present) and is indicated as **ONLINE**.

When shut down, the T/VDR informs the EMS of this event prior to shutting down, and the EMS indicates that the T/VDR is offline and shut down (refer to Section Error! Reference source not found.).

## 2.8 Connecting a TVDR

### 2.8.1 Overview

The TVDR can be connected to the EMS Standalone via a USB connection or TCP/IP connection. In the case of the EMS Server and the PLCA, the TVDR must be connected with a TCP/IP connection only.



The EMS Installer configures the EMS to work with the TVDR in USB or TCP/IP mode. Please make sure to select the appropriate option before attempting to connect the TVDR.

### 2.8.2 Connecting a TVDR for USB Connection



A USB connection allows a simple and fast connection between the TVDR and the EMS Standalone version. However, this connection is not reliable due to the nature of the USB connection and power management policies of Windows. It is recommended that this connection be used for demonstration purposes only.



When connected with a USB connection, make sure that the TVDR is connected **before** the EMS Standalone is started, and disconnected only **after** the EMS is shut down. Otherwise, the EMS will not be able to communicate with the TVDR.

During the installation of the EMS Standalone, the installer also installs the required drivers for the USB connection. Once installation is complete, simply plug the TVDR USB cable to the

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

computer and wait a few minutes for Windows to complete the TVDR installation. Once the installation is complete, you can start the EMS.

If the USB connection has been broken while the EMS is working (i.e. cable disconnected, computer went into sleep mode or hibernation, the user logs out, etc.), perform the following:

1. Close the EMS.
2. Disconnect USB.
3. Wait 5 seconds.
4. Reconnect USB.
5. Wait 5 seconds.
6. Restart the EMS.

To avoid scenarios where Windows disconnects the USB connection, perform the following steps:

1. Navigate to the computer's device manager (in Win XP: Control Panel > System > Hardware > Device Manager). Under Universal Serial Bus Controllers, right-click each USB Root Hub > Properties > Power Management and uncheck the option: "Allow this computer to turn off this device to save power".

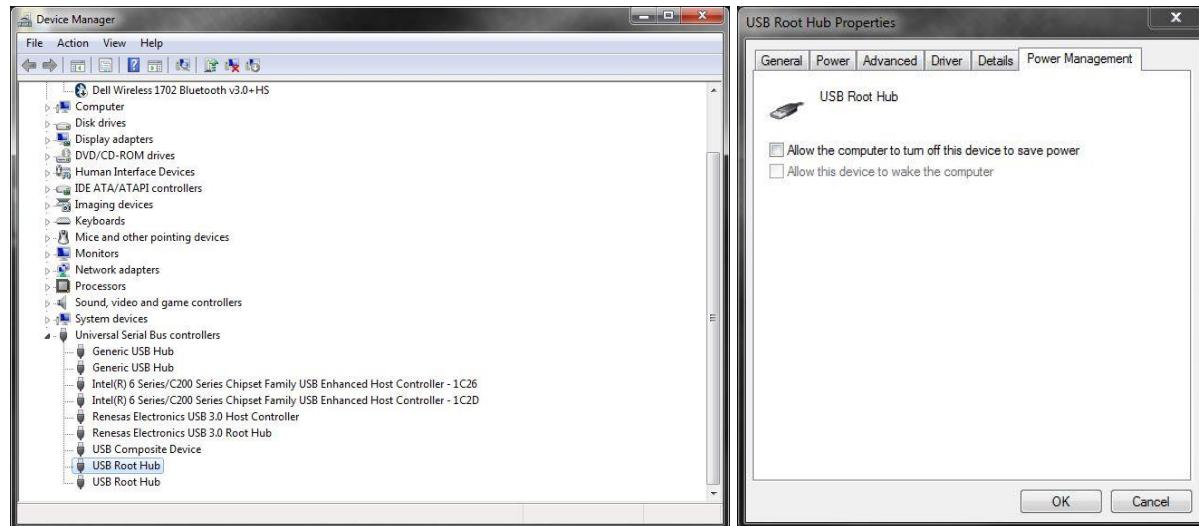


Figure 10: Preventing Disconnection of USB Connection

2. In the screen saver options, configure the computer not to go into hibernation.

### 2.8.3 Configuring a TVDR for TCP/IP Connection

To connect the TVDR to the EMS via TCP/IP connection, perform the following tasks:

1. Configure the IP addresses of the EMS and TVDR. Fixed TCP/IP addresses are recommended.
2. Configure the serial settings for the TVDR.

The **EMS Infrastructure Config** application will be installed by the EMS installer once a TCP/IP TVDR is selected. It is recommended to use this application for a One-Click configuration of the TVDR(s) as described in Section 2.8.4. Alternatively, a TELNET session at port 9999 can be set to manually configure the TVDR. Once a TELNET session is connected, change the fixed IP settings of the TVDR and the serial connection properties (including the target IP address –

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

namely the EMS Server, or EMS Standalone, or PLCA depending of the required solution) as described in Section 3.



TVDR TCP/IP connection and/or Setup will not be available in the following events:

1. TVDR is shutdown (**ON** LED is turned off)
2. USB terminal is connected and powered (**USB** LED is turned on)
3. Battery power is low (**LOW** LED is turned on)



For a manual TELNET configuration, it is recommended to use the provided application by LANTRONIX – the **Device Installer** – located under the folder **XPORT** in the provided installation disk.

### 2.8.4 EMS Infrastructure Configuration Utility

#### 2.8.4.1 Introduction

The EMS Infrastructure Configuration Utility provides a convenient way to view the status of all active TVDRs or configure them. Following connection of a TVDR to the Ethernet network and clicking the **Refresh** button, it is automatically listed in the Tunneling Routers Table (Figure 11).

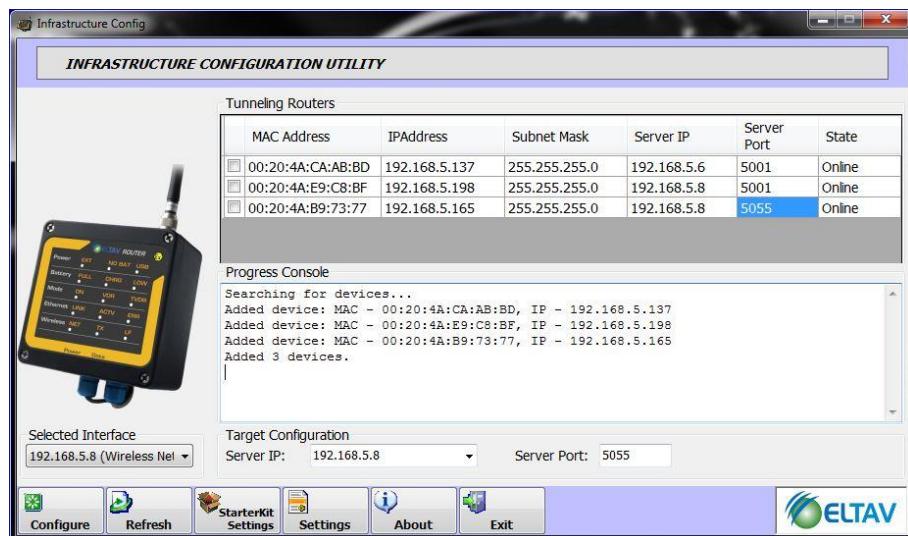


Figure 11: Infrastructure Configuration Tool



This application requires **CONFIGURATION** permission level. Please refer to Chapter Error! Reference source not found. for more related information.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

### 2.8.4.2 Configuring the TVDR(s)

The application will configure the TVDR(s) to connect with the EMS or PLCA. Most of the configuration values (installation-independent parameters) are applied automatically without user intervention. The following parameters must be provided by the user as follows:

1. Specify the IP address and Port of the EMS or PLCA.
  - i. In the event that the machine has more than a single network interface, the **Selected Interface** drop-down will be presented. All the existing network interfaces on that particular machine are presented and the user may choose which one to use in order to configure the TVDR(s). To select a network interface, click the drop-down list and select the preferred one.
  - ii. In the **Target Configuration** group, enter (or select from the list) the **Server IP** address. If this utility is running on the same computer running the EMS, the local IP address will be included in the drop down box values.
  - iii. In the **Target Configuration** group, enter the port number in the **Server Port** field. For a Standalone application always use port 5001. For a PLC or EMS Server application the default port is 5055.
2. Select the TVDR(s) to be configured
  - i. In the **Tunneling Routers** table click the checkbox to the left of the router MAC address. A **✓** sign will be displayed indicating the router is about to be configured. To unselect the router click the checkbox again.
  - ii. For each of the TVDRs about to be configured, verify and change their IP Address and Subnet mask as required.
  - iii. All other fields in the **Tunneling Routers** table are read-only and cannot be changed.
3. Click **Configure** to start the configuration process. The status of the TVDR under configuration is displayed in the **Progress Console**.
4. Click **Refresh** to update the status of the routers listed in the Tunneling Routers window.
5. Click **Starter Kit Settings** to change the Server IP to a local setting. This is relevant for a pilot demonstration.

### 2.8.4.3 Starter Kit Configuration

When demonstrating a starter kit system with a single TVDR connected by an Ethernet cable, follow these simple steps:

1. Connect a crossed Ethernet cable between the EMS and TVDR or Connect both EMS and TVDR through an Ethernet switch.
2. Verify that the local area network card has a valid IP address (consult with your IT support).
3. Verify that the TVDR is powered ON and is not powered by a USB cable or connected to the computer with a USB cable.
4. Start the configuration utility. Only a single TVDR should be listed in the **Tunneling Routers** table.
5. Click the checkbox in the **Tunneling Routers** table in order to select the TVDR.
6. Verify that the IP address of the TVDR is within the same subnet mask of the computer. Modify it if required.
7. Click the **Starter Kit Settings** button to configure the TVDR.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

### 2.8.4.4 Configuration Setup Window

The Configuration Setup window permits configuring several system-wide parameters.

1. To access the Configuration Setup window, click **Settings**.
2. In the field to the left of **Demand Log-In on Startup**, click on **True** or **False** to enable or disable log-in requirements. If set to false, the System Log-In window will be disabled.
3. Under **Connection Settings** click the **IP Address** to change the default IP address of the EMS or PLCA. The server IP is the address to which the TVDRs are connected.
4. Under **Connection Settings**, click the **TCP/IP Port** to change the default Port number.
5. Click **Save** to save the new settings.
6. Click **Reset** to return to factory settings.
7. Click **Exit** to return to the Infrastructure Configuration Utility.

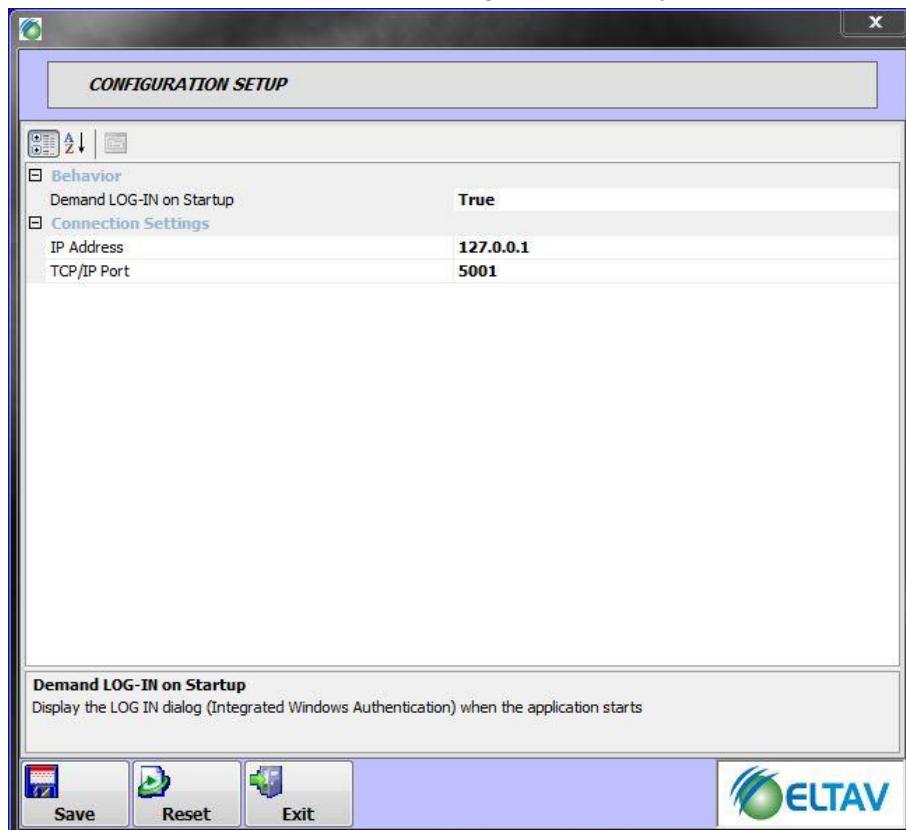


Figure 12: Configuration Setup Window

### 2.8.4.5 The About Window

Click **About** for information on the Infrastructure Configuration Tool.

## 2.9 Troubleshooting

### 2.9.1 T/VDR does not power on

1. Verify that jumper J5 is in place or external power (JP8 or USB over JP6) is applied.
2. Send a **Join/Join All** command to the T/VDR from a distance of 10 to 70 cm (refer to Section Error! Reference source not found.).
3. When a successful transaction occurs, the NET LED flashes for a few seconds.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

3. If the LF LED flashes while sending the LF command but the NET LED does not flash, disconnect and reconnect the flat cable between the T/VDR LED panel and main panel.



Sending a signal when the OD is too close to the T/VDR (a few centimeters) will saturate the T/VDR receivers and the transaction will be aborted.

### 2.9.2 T/VDR does not join the wireless network

The Net LED is not lit.

1. Verify that a wireless network exists. At least one TVDR is required to form a wireless network.
2. The VDR is in a different network; it cannot move between networks automatically. Use the OD to manually move it.

### 2.9.3 VDR is not displayed in EMS but the NET LED is lit

The VDR is located in a different wireless network. Within a few minutes the VDR will automatically leave the network and turn off the Net LED. Perform the steps in Section 2.9.2.

### 2.9.4 TVDR does not go online

The indication on the bottom left side of the EMS indicates that the TVDR is not connected. Perform one the following steps to resolve this situation, depending on the scenario.

1. The TVDR is connected using a USB connection while the EMS expects a TCP/IP connection. Change the EMS configuration appropriately.
2. The TVDR is connected using a USB connection and Windows assigned a COM port above 200. Contact your IT support to assign the TVDR a COM port below 200.
3. The TVDR is connected using a TCP/IP connection while the EMS expects a USB connection. Change the EMS configuration appropriately.
4. Refer to Section 2.9.6.
5. The EMS IP address that is configured in the TVDR is incorrect. Reconfigure the EMS IP.

In order to change the EMS configuration between TCP and USB connection:

1. Reinstall the EMS and select the correct configuration (Refer to Section Error! Reference source not found.).
2. Change configuration settings of the field **Switch Tunneling Router Connection to USB** in the EMS configuration settings window (Refer to Section Error! Reference source not found.).

### 2.9.5 Reception is poor

1. Verify that antenna is properly connected.
2. Verify the transmission power settings of the T/VDR under the Setting tab (refer to Section Error! Reference source not found.).

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

### 2.9.6 LINK indication is not lit (for TCP/IP connection only)

1. Verify that the Ethernet cable is properly connected on both sides.
2. Make sure that external power is applied via JP6 and not via JP8.
3. Browse with an Internet browser to the IP address of the TVDR. Navigate to **Configurable pins** and verify the following:
  - i. First entry in the table is set to **Link Status**.
  - ii. Third entry in the table is set to **Status LED 3**.If any of the above entries are different, apply the new settings, press the **OK** button and then press the **Apply Settings** option of the menu to the left.
4. Verify that the ambient temperature of the TVDR is lower than +70°C. (If the TVDR is placed in direct sunlight it can warm up considerably.)



#### IMPORTANT

To avoid exceeding the maximum operational temperatures, we recommend, in hot and sunny environments, that the device be positioned in a shady location away from direct sunlight.

5. If LOW LED is lit, the LAN is automatically shut down. Connect the device to external power.



#### NOTE

When the device is powered via the USB connection, the LAN is intentionally disconnected. USB communication has priority over that of the TCP/IP.

### 2.9.7 NO BAT LED is lit

1. Verify that jumper JP5 is in place.
2. Verify that the battery is in place.
3. If these steps do not resolve the problem, replace the unit and return to your Eltav representative.

### 2.9.8 Cannot connect to the device during a TELNET session

This FAQ applies to the sequence suggested in Section 3.

1. Verify that the device is connected to the same TCP/IP network.
2. Verify that the device is powered on and operational (ON LED is lit).
3. Verify that the device is not also connected with the USB (the USB will supersede and disconnect the LAN periphery of the TVDR).
4. Verify that the device has a valid TCP/IP address. In some cases, it might have an initial non-valid TCP/IP address of 169.254.x.x and show in red in the tabular display. If this is the case, click Assign IP to assign the IP address, and then use the TELNET setup to configure the reset.
5. Verify that the IP address does not conflict with other IP addresses in your network. Consult with your IT support to resolve.

## **Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)**

### **2.9.9 Cannot find the device in the configuration utility (Infrastructure Config)**

1. Verify that the device is connected to the same TCP/IP network.
2. Verify that the device is powered on and operational (ON LED is lit).
3. Verify that the device is not also connected with the USB (the USB will supersede and disconnect the LAN periphery of the TVDR).
4. Verify that the IP address does not conflict with other IP addresses in your network. Consult with your IT support to resolve.

### **2.9.10 Cannot configure the device in the configuration utility (Infrastructure Config)**

1. Verify all items in paragraph 2.9.9.
2. Verify that the computer in use has a valid IP address for the relevant LAN. For example, if the connection between the computer and TVDR is intended for **local area network 1**, then make sure this LAN has a valid IP address.
3. Verify that both computer and TVDR share the same subnet. Otherwise use the utility to change the IP address of the TVDR prior the attempt to configure the TVDR.

### **2.9.11 TCP/IP connection with the device is not stable**

1. Verify that all 4 TCP/IP wires are properly connected to JP7 and in the correct order.
2. Verify that a CAT5 Ethernet cable is in used. The Ethernet cable has 4 twisted pairs of wires. A cable without twisted pairs will not provide the required infrastructure for the physical layer of the TCP/IP protocol.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

### 2.9.12 or Uninstalling an EMS installation

Temp	22	-40 to +85(°C)	The ambient VD temperature in Celsius (°C) or Fahrenheit (°F).
Volt	3344	1800 to 3800	Voltage of the VD batteries (in millivolts).
RSSI	-47	-10 to -100	Radio signal strength in [dBm] units.
GROUP	0	0 to 120	VDs can be grouped (for example on a logical basis according to process lines).
STAT	0x804C		Information reserved for higher level of troubleshooting.

The **Up/Down** keys cycle through the information. The **Tab** key returns the display to the default control of a specific VD.

Every valve movement updates the information in this particular OD menu mode. This mode times out within 60 seconds of no valve activity.

#### 2.9.12.1 View VD Configuration

A long press of the **Test** key presents the full configuration data of the VD. Navigate through the information cyclically in same manner as in the VD status. The full set of configuration data is presented in the following table.

**Table 7: VD Full Configuration Information**

Parameter	Sample Value	Description
Network	0x0881	Presents the ZigBee Network ID to which the VD is joined.
Parent	0x5278	Presents the Parent ID of the VD (16 bit).
Channel	12	RF (ZigBee) Channel used by VD.
TX Power	3	RF (ZigBee) Transmit power for the VD (in dBm).
TX Cycle	300	Interval at which the VD sends keep-alive messages (in seconds).
RX Cycle	300	Interval at which the VD polls its parent for pending messages (in seconds).
Blink Cycle	30	Interval at which the VD blinks its LEDs (in seconds).
Open Ang	101	Angle in VD relative axis at which the valve is assumed to be open (in degrees).
Open Tol	5	Tolerance [+/-] in detection of the open angle (in degrees).
Close Ang	11	Angle in VD relative axis at which the valve is assumed to be closed (in degrees).

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

Parameter	Sample Value	Description
Close Tol	5	Tolerance [+/-] in detection of the closed angle (in degrees).
Custom Ang	40	Angle in VD relative axis selected by the customer at which the valve reports <b>CUSTOM</b> position (in degrees).
Custom Tol	5	Tolerance [+/-] in detection of the <b>CUSTOM</b> angle (in degrees).
Low Temp	2	Alert will be generated if internal temperature measurement is below this value (always given in Celsius degrees).
High Temp	65	Alert will be generated if internal temperature measurement is above this value (always given in Celsius degrees).
Low Volt	2800	Alert will be generated if battery measurement is lower than this value (in millivolts).
Sample Rate	20	Sampling interval of the valve stem position (in millisecond units).
Prescaler	2	Factor for slower sampling of valve stem position while motion of the stem is detected.
Steady State	80	Required duration without valve stem movement to declare end-of-movement (in millisecond units).
Dynamics	NO	YES if the dynamics analysis is activated in the VD. NO otherwise.
Min Opn Trans.	400	If dynamics analysis is active and VD movement towards an OPEN valve position is faster than this value, an alert for dynamics is generated (in millisecond units).
Max Opn Trans.	1920	If dynamics analysis is active and VD movement towards an OPEN valve position is slower than this value, an alert for dynamics is generated (in millisecond units).
Min Cls Trans.	400	If dynamics analysis is active and VD movement towards a CLOSED valve position is faster than this value, an alert for dynamics is generated (in millisecond units).
Max Cls Trans.	1920	If dynamics analysis is active and VD movement towards a CLOSED valve position is slower than this value, an alert for dynamics is generated (in millisecond units).
Status	0x0003	Reserved for higher level of troubleshooting.

### 2.9.12.2 Cal (Calibrate)

1. Press the **Cal** key to calibrate a VD. The blinking bottom line presents the first calibration command.
2. Use the **Up/Down** keys to move cyclically among the calibration procedure commands and press **Enter** to make a selection. The following commands are available:

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

- **Reset Cal:** Reset present calibration angles to enable a new setting. This must be performed prior to new calibration procedure.
- **Set Open:** Sets present angle as the open valve position.
- **Set Close:** Sets present angle as the closed valve position.
- **Set Custom:** Sets present angle as a custom valve position.
- **Apply:** Apply the selected angles. This must be performed after a calibration procedure in order to save it.
- **Dev Config:** Allows sending stored configuration templates (within the OD) to the VD.
- **TVDR Group:** Switches VD between logical process lines (Connectivity Groups).
- **Set Temp:** For Eltav's use only. Calibrates offset of VD's internal temperature sensor.
- **Exit:** Leaves the Calibration menu.

### 2.9.12.3 Name

This command allows the user to change the VD Tag. This Tag will later link the VD to the users PLC/SCADA/HMI based on the connectivity setup (refer to chapter Error! Reference source not found.). To facilitate the change follow these steps:

1. Open an LF Session between the OD and the VD. The VD will not be able to receive its new Tag until an LF Session is active.
2. Press the **Name** button to enter the **Tag** sub menu. The blinking bottom line presents the first **Tag** command.
3. Use the **Up/Down** keys to move cyclically among the **Tag** procedure commands and press **Enter** to make a selection. The following commands are available:
  - **Search:** When the set of Tag entries inside the OD is too large to cyclically navigate, this menu option allows the user to filter the set of entries. Use the **Up/Down/Tab** keys to filter out the set. As the filter value changes, the number of valid entries is reduced (and displayed on the second text line). Press the **Enter** key to select the filter setting and move to the menu option **List**. Double press the **Tab** key to reset the filter setting.
  - **List:** Browse cyclically through the predefined Tag entries in the OD or the set of filtered entries selected in the **Search** menu option. To update the predefined Tag entries in the OD, refer to Chapter Error! Reference source not found..
  - **New:** When a desired Tag entry is not present in the OD, the user can type the new Tag entry using the **Up/Down/Tab** keys.
  - **Exit:** Exit the Tag menu without sending a Tag to the VD.
  - **Re-send:** if sending the Tag to the VD failed and/or the VD did not acknowledge, the OD allows a quick method to resend the same Tag to the VD. This option will show as the first option in the Tag menu **after** a failed attempt.
4. Press **Enter** to execute the requested command



This menu, as well as the LF Session, times out after 60 seconds . After this timeout, the VD will not be able to receive the Tag, and a new LF Session must be opened prior to a second attempt.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)



A VD Tag can also be changed from the EMS under the appropriate configuration menu (refer to Section Error! Reference source not found.).

### 2.9.12.4 Leave

This command causes the selected VD to leave the network and shutdown. An **Ack** is sent from the VD to the OD prior to actually leaving.

### 2.9.12.5 Reset

This command causes the selected VD to reset its firmware. An **Ack** is sent from the VD to the OD prior to actually resetting. After resetting, the VD will return to its previous operational state automatically (namely, return to the wireless network and resume functionality).

### 2.9.12.6 Reset Setup

This command causes the selected VD to reset its configuration to factory defaults. An **Ack** is sent from the VD to OD prior to configuration change. To send this command, press and hold the **Reset** key (Long Press). The VD will retain its Tag (Device ID) through this process in order to avoid confusion. To revert to the VD Tag, use the **Name** command (Refer to Section Error! Reference source not found.).

## 2.9.13 Working with an Offline Valve Device (VD)

Working offline with a specific VD is relevant if the ZigBee network is not available and operations can only be performed on the LF channel from the OD to a VD (no response from the VD). In such a case, the following functions are available:

- Broadcast Commands:
  - Join All
  - Leave All
  - Reset All
- Specific Commands (after keying in VD MAC#):
  - Join
  - Leave
  - Reset
  - Name
- Calibration: Allows configuration of system for items such as open/closed angles, temperature offset, etc.

## 2.9.14 Working with an Online VDR

During an open session with a specific T/VDR, the entire VDR mode functionality is available.

### 2.9.14.1 Identification

Since every T/VDR can be identified by either its MAC Number or Tag, this command presents both the MAC Number and the Tag on the OD display.

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

### 2.9.14.2 View T/VDR Status

A short press on **Test** presents the recently updated T/VDR status. T/VDR status consists of the data in the following table.

**Table 8: T/VDR Status**

Parameter	Sample Value	Valid Value Range	Description
Children	15	0 to 32	Number of VDs currently connected to this T/VDR as a parent.
Neighbors	3	0 to 16	Number of entries in the route table of the T/VDR. Suggests the number of T/VDRs and ODs the T/VDR can connect with simultaneously.
Volt	4180	1800 to 4200	Voltage of backup battery (in millivolts).
Node ID	0x0000	0x0 to 0xFFFF	A 16-bit short ID of the T/VDR. This is not the operational ID but the ID used by the communication network.
Network	0x0881	0x0 to 0x3FFF	Presents the ZigBee Network ID the T/VDR is joined to.
Channel	12	11 to 26	RF (ZigBee) Channel used by T/VDR.
GROUP	0	0 to 120	VDs can be grouped on a logical basis according to process lines. They convey message to TVDRs on the same group.
STAT	0x1702		Information reserved for higher level of troubleshooting.

The **Up/Down** keys cycle through the information. The **Tab** key returns the display to the default control of a specific VDR.

Every T/VDR status message updates the information in this particular OD menu mode. This mode times out within 60 seconds of no status update.

### 2.9.14.3 Name

This command allows the user to change the T/VDR Tag. This Tag will later link the T/VDR to the user's PLC/SCADA/HMI based on the connectivity setup (refer to chapter Error! Reference source not found.). To facilitate the change, follow these steps:

1. Open an LF Session between the OD and the T/VDR. The T/VDR will not be able to receive its new Tag until an LF Session is active.
2. Press the **Name** button to enter the **Tag** sub menu. The blinking bottom line presents the first **Tag** command.
3. Use the **Up/Down** keys to move cyclically among the **Tag** procedure commands and press **Enter** to make a selection. The following commands are available:

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

- **Search:** When the set of Tag entries inside the OD is too large to cyclically navigate, this menu options allows the user to filter the set of entries. Use the **Up/Down/Tab** keys to filter out the set. As the filter value changes, the number of valid entries is reduced (and displayed on the second text line). Press the **Enter** key to select the filter setting and move to the menu option **List**. Double press the **Tab** key to reset the filter settings.
- **List:** Browse cyclically through the predefined Tag entries in the OD or the set of filtered entries selected in the **Search** menu option. To update the predefined Tag entries in the OD, refer to Chapter Error! Reference source not found..
- **New:** When a desired Tag entry is not present in the OD, the user can type the new Tag entry using the **Up/Down/Tab** keys.
- **Exit:** Exit the Tag menu without sending a Tag to the T/VDR.
- **Re-send:** if sending the Tag to the T/VDR failed and/or the T/VDR did not acknowledge, the OD allows a quick method to resend the same Tag to the T/VDR. This option will appear as the first option in the Tag menu **after** a failed attempt.

4. Press **Enter** to execute the requested command.

 **NOTE**

This menu times out after 60 seconds as well as the LF Session. After this timeout, the T/VDR will not be able to receive the Tag, and a new LF Session must be opened prior to a second attempt.

 **NOTE**

A T/VDR Tag can also be changed from the EMS under the appropriate configuration menu (refer to Section Error! Reference source not found.).

### 2.9.14.4 Leave

This command causes the selected T/VDR to leave the network and shut down. An **Ack** is sent from the T/VDR to the OD prior to actually leaving.

### 2.9.14.5 Reset

This command causes the selected T/VDR to reset its firmware. An **Ack** is sent from the T/VDR to the OD prior to resetting. After resetting, the T/VDR will return to its previous operational state automatically (namely, return to the wireless network and resume functionality).

## 2.9.15 Working with an Offline T/VDR

Working offline with a specific T/VDR is relevant if the ZigBee network is not available and operations can only be performed on the LF channel from the OD to a T/VDR (no response from the T/VDR). In such a case, the following functions are available:

- Broadcast Commands:
  - Join All
  - Leave All
  - Reset All

## Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)

- Specific Commands
  - Join
  - Leave
  - Reset
  - Name

## 2.10 OD Troubleshooting

### 2.10.1 OD Does Not Communicate with VD

1. Verify that the OD is in Network Mode as presented in Section Error! Reference source not found..
2. Verify that the ZigBee network is properly functioning as presented in Section Error! Reference source not found.. Without ZigBee network support, the OD can use only one-way communication on the Low Frequency (LF) channel (from OD to VD). Thus no acknowledgement from the VD can be received. Only an OD operating in the same wireless network as the VD can receive acknowledgements from the designated VD.

### 2.10.2 OD Does Not Communicate with T/VDR

Refer to Section Error! Reference source not found., as VD and T/VDR behave in the same way with respect to communication with the OD.

### 2.10.3 Low Battery Indication

In the event that the LOW BAT LED is lit, connect the provided USB cable in order to charge the battery. Depending on computer configuration, charging can take between 1 and 10 hours. A standard USB charger can also be used to charge the OD.

### 2.10.4 Operator Device is not Responsive

In the event that this phenomenon occurs, the device automatically logs out, shuts down and recovers within 5 minutes of no usage. Alternatively, reset the device using the Eltav Operator Device Utility (refer to Chapter Error! Reference source not found.).

### 2.10.5 Powering Up the Operator Device

To activate the OD, press **Log In** and **Enter**. Do not press the **Power** button for this purpose.

### 2.10.6 Powering Down the Operator Device

To power down the OD, press **Log Out** and **Enter**. Do not press the **Power** button for this purpose.

### 2.10.7 OD will not Log In

The default login password (as the device is shipped from Eltav) is "0000". Additional login passwords can be added using the Eltav Operator Device Utility (refer to Chapter Error! Reference source not found.).

### 2.10.8 Software Failure

In the event of a software failure, a new version of the OD application can be downloaded by the Eltav Operator Device Utility (refer to Chapter Error! Reference source not found.) and loaded via a standard USB connection into the OD.

### 2.10.9 Can't Reopen a Session between the VD to the OD

When the VD is in an active session, the OD cannot reopen the session. This can happen if the VD opens a session per OD request but the OD fails to receive an acknowledgement from the VD, and therefore the OD does not open the session.

In this scenario, the OD request to reopen the session (pressing the **ENTER** key) will not yield the expected result, since the OD request does not reach the VD residing inside the session.

To resolve this, do one of the following:

1. Wait 60 seconds for the VD to automatically exit the session and then try again.
2. Perform the following key sequence **ENTER>ENTER>IDNT>ENTER>ENTER>IDNT** while the MAC address of the VD appears on the upper text line of the OD LCD display.



Each session ID has a session identifier. A Device (VD or T/VDR) that recognizes a session with a different session identifier will immediately leave its current session. This is useful for the following cases:

- Opening a session on a neighboring Device (VD or T/VDR) while not compromising the previous Device.
- Reopening a session with a Device by falsifying a different session.

### 2.10.10 Can't Reopen a Session between the T/VDR to the OD

Refer to Section Error! Reference source not found., as the VD and the T/VDR behave in the same way with respect to communication with the OD.

## **Valve Device Router (VDR) / Tunneling Valve Device Router (TVDR)**

## 3 Appendix A – Manual TELNET Configuration for the TVDR

This chapter provides information about the methods of manually configuring the TVDR.

- ✓ **Overview**
- ✓ **Installation**
- ✓ **Usage**

### 3.1 Overview

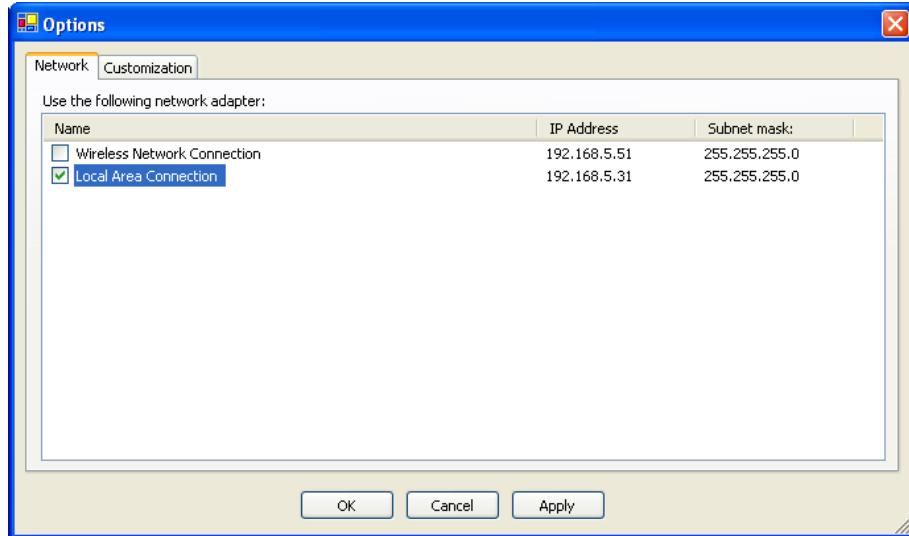
The EMS installer provides the ability to configure the TVDR with a One-Click application – the **EMS Infrastructure Config** application. For cases where the user desires to manually configure the TVDRs or when the provided application fails to perform the task, an alternative method is presented herein.

The following are detailed steps in regard to configuring the TVDR for TCP/IP settings using the Device Installer provided by LANTRONIX. We recommend performing the following steps using this application. However, a simple TELNET session with any other application will yield the same results.

### 3.2 Installation and Setup of the *Device Installer*

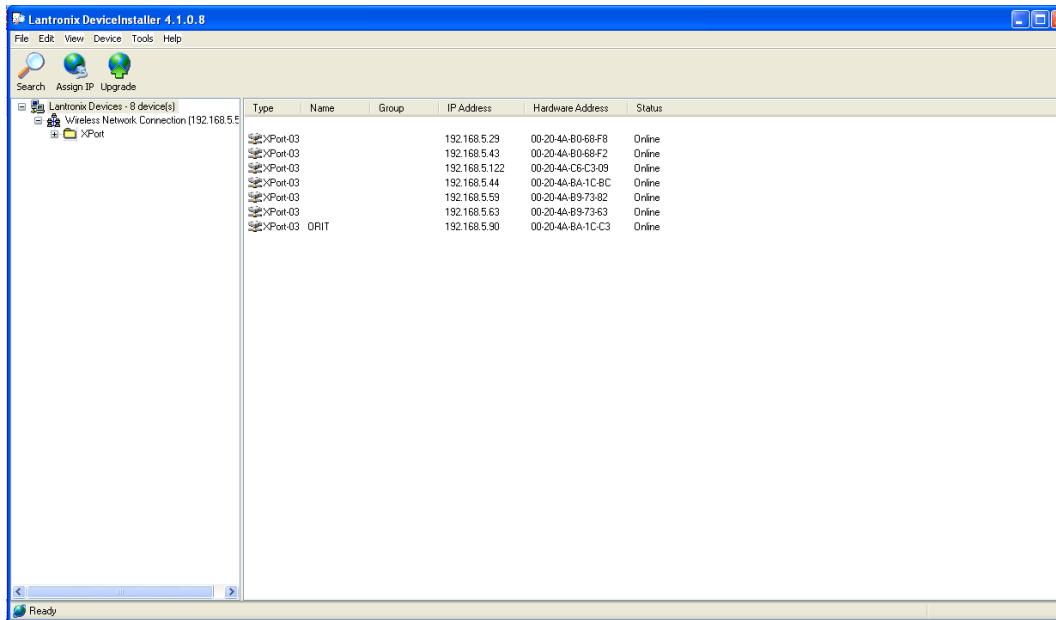
1. Install the Device Installer from the provided installation disk. The installation is located under the folder **XPORT**.
2. Once installed, verify that the correct LAN port is used on the computer. Always use wired LAN rather than Wireless LAN to find the TVDR. Select the network adapter under the **Tools>Options** menu.

## Appendix A – Manual TELNET Configuration for the TVDR



**Figure 13: Selecting the Network Adapter Settings**

3. Make sure that the TVDR is powered-on and connected to the same TCP/IP network as the computer LAN. Click **Search** in the device installer. The following window is displayed (Figure 14).
4. A list of LANTRONIX devices appears in the right pane. Double click the TVDR you would like to set up. If only a single TVDR is connected, there should be a single entry in the list.



**Figure 14: Selecting a TVDR**

5. Navigate to the Telnet Configuration tab and click **Connect**.
6. Follow the instructions that appear in the Telnet window in order to configure the device. The TELNET session closes automatically if there is no activity.

## Appendix A – Manual TELNET Configuration for the TVDR

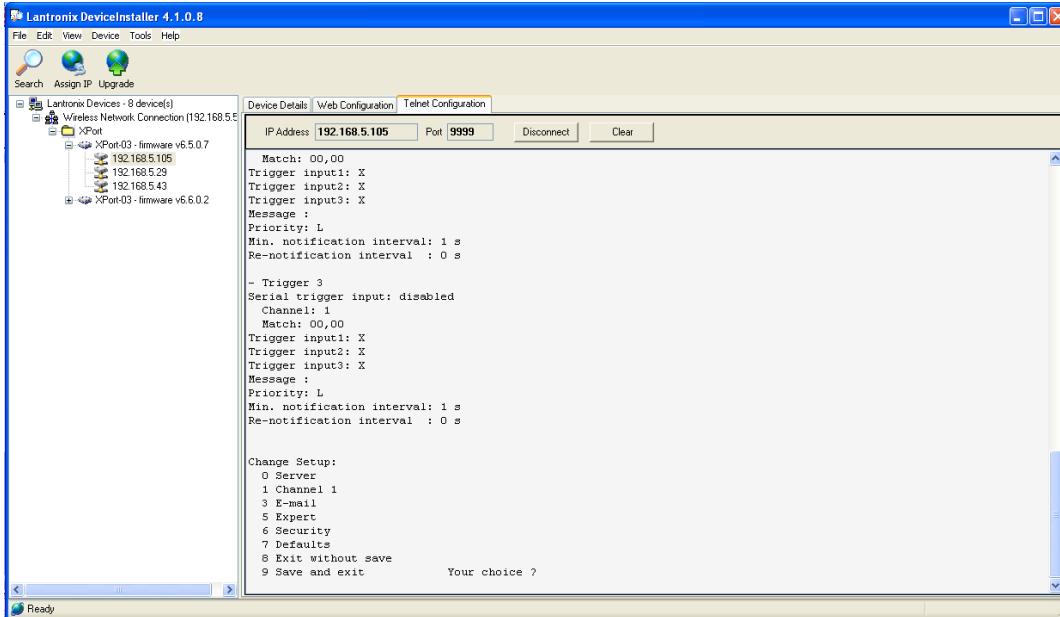


Figure 15: Telnet Configuration Window

### 3.3 Configuring the TVDR with a TELNET session

1. Once a TELNET session is open with the TVDR, update the following:
  - **Menu option 0 – Server:** (refer to Section 3.3.2).
  - **Menu option 1 – Channel 1** (refer to Section 3.3.1)  
When entering Menu option 0 or Menu option 1, you will receive a set of configuration options. Each option will show the current value, followed by the "?" sign. Press **Enter** to retain the current value. Otherwise, enter a new appropriate value as required.
2. Once the configuration is complete, click menu option “**9**” to save and exit the session.



Do not disconnect the TVDR while within the TELNET session. While in the TELNET session, the TVDR will not be able communicate with the EMS and the **ERR** LED may be flashing.

In most cases, you are required to change two configuration entries:

- **Remote IP Address:** This is the IP address of the EMS Standalone, or EMS Server, or PLCA.
- **Remote Port:** This is the TCP/IP port of the target (EMS Standalone, or EMS Server, or PLCA). Always use port 5001 for EMS Standalone. For the EMS Server and the PLCA usually use port 5055; however this value is configurable on the other side as well.



Configuration entry “**Remote Port**” must be **5001** when using the EMS Standalone application.

## Appendix A – Manual TELNET Configuration for the TVDR



Configuration entry “**Port No**” must always remain as **10001**.

### 3.3.1 Settings for Menu Option 1

Menu option 1 configures the serial connection between the TVDR and the EMS or PLCA. The following table provides the required settings for Menu option 1.

**Table 9: Settings for Menu Option 1**

Configuration Entry	Required Value
Baudrate	230400
I/F Mode	4C
Flow	00
Port No.	10001
ConnectMode	C1
Send '+++' in Modem Mode	Y
Show IP addr after 'RING'	Y
Auto increment source port	N
Remote IP Address	IP address of the EMS Standalone / EMS Server / PLCA
Remote Port	5001 for EMS Standalone, 5055 for EMS Server or configured port of the PLCA
DisConnMode	00
FlushMode	80
Pack Cntrl	00
DisConnTime	00:00
SendChar 1	00
SendChar 2	00

### 3.3.2 Settings for Menu Option 0

Menu option 0 allows you to change the fixed IP address of the TVDR. The following table includes the menu option setting for the TVDR.

## Appendix A – Manual TELNET Configuration for the TVDR

**Table 10: Settings for TVDR**

Configuration Entry	Required Value
IP Address	Fixed IP address of the TVDR
Set Gateway IP Address	N
Netmask: Number of Bits for Host Part (0=default)	8
Change telnet config password	N

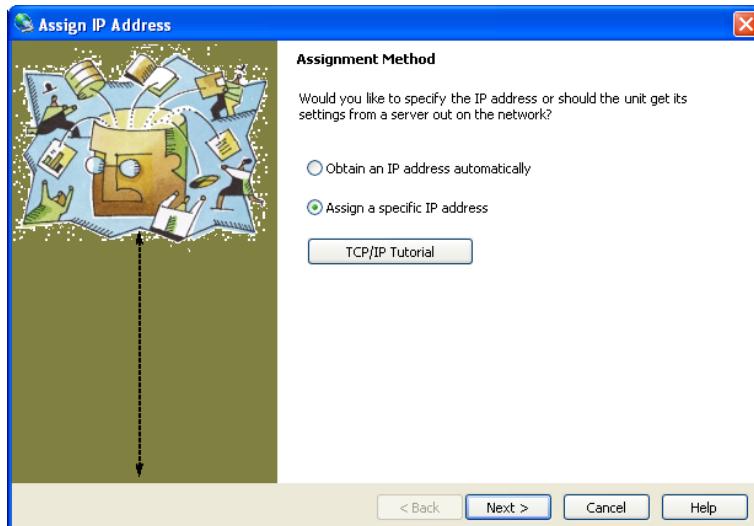


Setting the IP Address field (under menu option 0) to all 0s (0.0.0.0) will activate the DHCP service in the TVDR. Working with the DHCP compromises the reliability of the TVDR and is not recommended.

### 3.3.3 Assignment of a fixed IP to the TVDR

The fixed IP address of the TVDR can also be set by pressing **Assign IP** in the main menu.

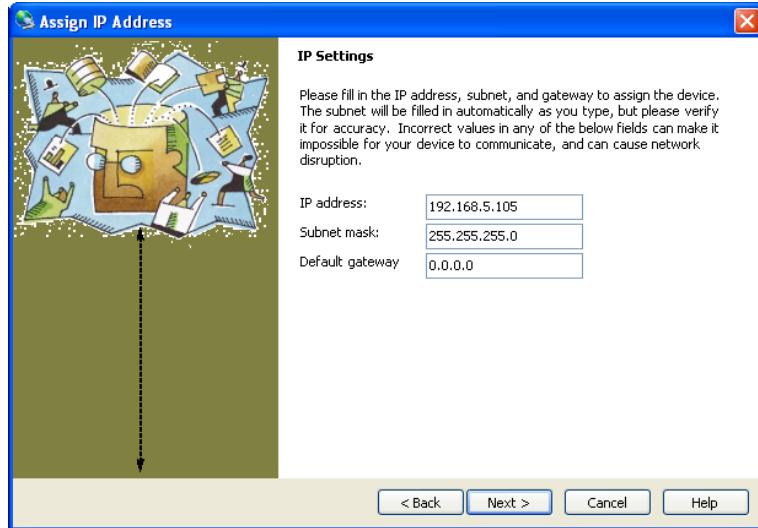
1. Select the device in the table and click **Assign IP**.
2. Click **Assign a specific IP** and click Next.



**Figure 16: Assigning an IP Address**

3. Configure the required IP address, keeping the other fields as shown in the following illustration (255.255.255.0 and 0.0.0.0).
4. Click **Next** and then click **Assign**.

## Appendix A – Manual TELNET Configuration for the TVDR



**Figure 17: Assigning IP Settings**

5. Open a TELNET session again and verify that the serial configuration (menu option 1) is configured correctly and has not changed or been corrupted (Please refer to Section 3.3.1).

## **Appendix A – Manual TELNET Configuration for the TVDR**

