Reliable Data Communication via GSM Networks

ETHERNET

REMOTE

LOCAL

Meeting harsh environmental challenges

westermo®
www.westermo.com

Save Time and Money with Secured Wireless Connections Worldwide

The ability to create remote connections to equipment can provide companies great savings both in time and money. Not only this, but improved customer service can also be offered. It is possible to control, monitor, update software or fault find, irrespective of where the equipment is located, by means of a simple remote connection.

Being able to connect to a remote server whilst working from home or using a laptop PC when travelling makes for much more efficient and flexible working conditions for many support engineers.

Why use industrial products?
Westermo designs and develops products for use in industrial applications and environments with high interference levels. With over 30 years of experience we are fully conversant with the market's need for reliability and functionality, where a product is expected to work faultlessly for many years.

These are some of the factors that we consider when we develop a new product to provide an optimal final cost.

The GSM-series:

The natural choice for reliable GSM applications in harsh environments

Westermo GSM-modems allow all kinds of serial equipment to communicate anywhere within the coverage of a GSM radio base transceiver station.

- 900/1800 MHz
- 850/1900 MHz
- GPRS, class B, class 10
- Integrated TCP/IP stack
- TCP auto connect
- RS-232 / RS-422 / RS-485
- DTR -dialling or SMS
- Isolated power supply
- Signal strength indicator
- Configuration: • GDW-Tool • DIP-Switches • AT-Commands

See specific product regarding available features.

GD-Tool
The Easy way to Configure Modems
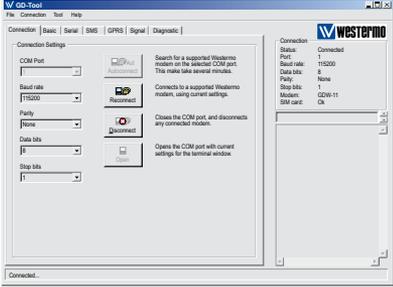
The Westermo GD-Tool provides two ways to configure our GSM/GPRS modems. AT commands can be entered into a terminal window or the user friendly GD-tool configuration screens can be used.

To use GD-tool firstly a serial connection must be made to the modem with a standard cable. Next the GD-tool is started on the PC. Options are provided to either Auto-connect or Reconnect and the tool will automatically download parameters about the current configuration.
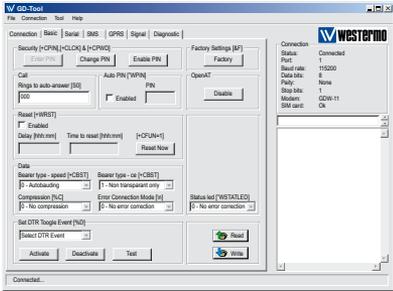
The tool offers several configuration menus:

⠿ **Connection**
⠿ **Basic**
⠿ **Serial**
⠿ **GPRS**
⠿ **Signal**
⠿ **Diagnostic**
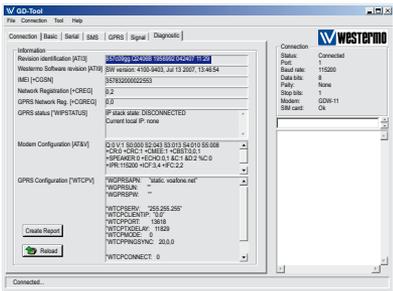
The Diagnostics screen provides vital help for any service technician trying to diagnose a fault with a connection.

Configuration files can be saved onto a PC so once the correct configuration is found a particular brand of PLC for instance this can be saved and then downloaded into other modems to speed up and simplify future installations.
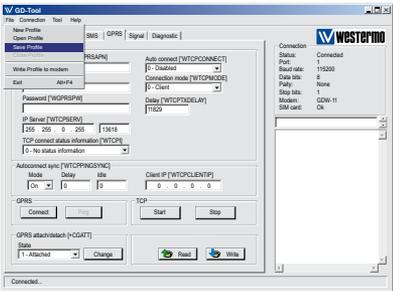
The possibility to save a configuration file makes it very convenient for e.g. a system integrator who works with different brands of PLC's. Just make the configuration ones for each specific device and save the file and then download the file to the next modem.

GSM

(Global System for Mobile communication)

Connection time between GSM modems is 4 – 8 seconds (using the V.110 protocol).

GSM makes the wireless transfer of voice/text/images between different types of equipment possible, but only within the coverage area of a network operator's base transceiver station. It is possible to use GDW-11 / GD-01 on different operators networks and between different countries (*Roaming*).

The number of users of GSM equipment has, after standardisation, increased rapidly, primarily with voice services, but a major increase is now also occurring within industrial applications, in particular M2M communication, *(Machine to Machine)*.

This can be to transfer data or alarms from a number of slave units to a master system or the transfer of data from or between parking meters and other similar equipment. The application and possibilities are endless.

Architecture of a GSM Network

ME (*Mobile Equipment*): Each ME unit has a unique identification IMEI-number, (International Mobile Equipment Identy). This makes it possible for the network operator to block the use of a unit, e.g. when a ME unit has been stolen.

SIM (*Subscriber Identity Module*): The SIM-card is furnished by the network operator and holds data such as: telephone number, PIN code, address book etc.

BTS (*Base Transceiver Station*): Is a base radio station, i.e. a transmitter and receiver that makes it possible to communicate with some form of ME.

BCS (*Base Station Controller*): Is a substation that communicates with the base radio station. The substation can communicate with a number of base stations.

MSC (*Mobile Switching Centre*): Makes forwarding to an analogue, PSTN (*Public Switched Telephone Network*) or an ISDN (*Integrated Services Digital Network*) digital network possible.
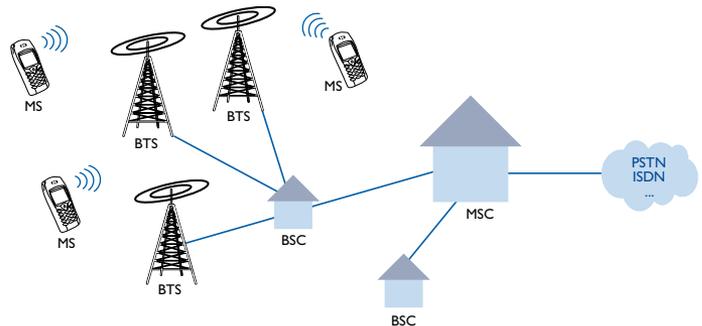
Cell structures

Base stations are positioned to give maximal coverage. The area covered by a base station is called a cell.
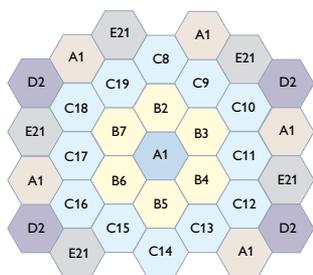
The entire GSM network is organised with cells of varying sizes. A cell can cover areas with a radius of 200 metre (656 ft) up to areas with a radius of ~30 km (18.64 mi). This depends on where the base station is located and the surrounding environment.

Other factors that affect the installation are, among others, the output power and whether the base station is located in an environment that is problematic for radio traffic. The cell structure results in the reuse of frequencies in the base stations. In the figure on the left shows that the frequency A1 can be reused in the third ring without the risk of crosstalk between cells with the same frequency.

If you travel through an area it is necessary to switch between the cells through which you pass. This is known as handover.

Radio transmissions between MS and BSS

In the eighties when the GSM specification was drawn up, the ITU (International Telecommunication Union) reserved two frequency bands of 25 MHz for GSM radio transmissions:

- 880–915 MHz "uplink" transfers from MS to BSS.
- 925–960 MHz "downlink" transfers from BSS to MS.

The development within mobile communication has resulted in the need to use multiple frequencies to satisfy demand. Today there are five standardised frequencies 400, 850, 900, 1800 as well as 1900 MHz. The latter frequency is generally used in the USA and in some parts of Asia, while 900 and 1800 are more globally used.

Services on the GSM network

There are a number of services available via GSM such as:

- Telephony.
- CSD (Circuit Switched Data, data transfer).
- SMS (Short Message Service).
- MMS (Multimedia Message Service).
- FAX.
- GPRS (General Packet Radio Service).
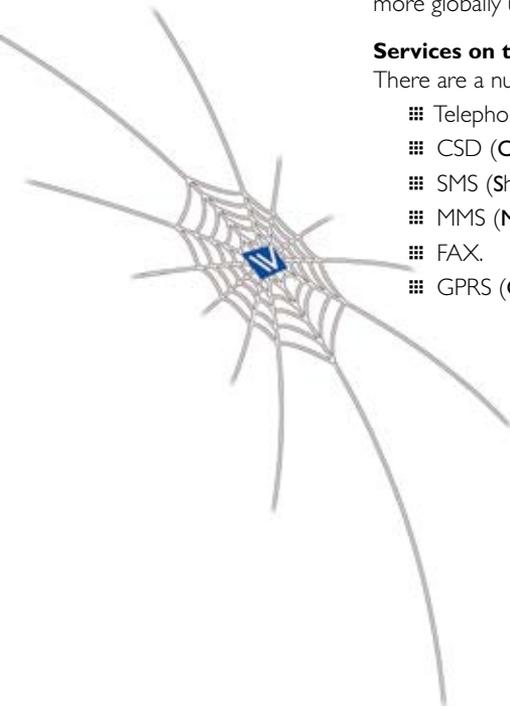
Circuit Switched Data

A CSD connection makes it possible to transfer serial data at speeds from 300 bit/s up to 14.4 kbit/s depending on network providers.
The table on the right side shows the available speeds and protocols.

Data communication can be set up for transparent or non-transparent data transfer. RLP (**R**adio **L**ink **P**rotocol) is used in non-transparent transfer; this is an error corrected GSM protocol. This protocol creates a more reliable transfer, but also generates delays in the transfer. In order to use this function requires the support of both the service and the connected devices.

Speed	Protocol
2400 bit/s	V.22 bis
4800 bit/s	V.32
9600 bit/s	V.32
14400 bit/s	V.32 bis
2400 bit/s	V.110
4800 bit/s	V.110
9600 bit/s	V.110
14400 bit/s	V.110

CSD Connection (Circuit Switched Data)

To be able to make a connection to GSM modem is a SIM-card required from a GSM Network Provider to obtain a telephone / data number. It's the possible from a remote site to connect the GSM-modem or vice versa.

As the connection is made through a circuit switched network are you constantly connected until the line is disconnected.

Network security

The most imported security mechanisms on the GSM Network is:

• Strong authentication of user (SIM / Pin Code).
• Encryption of data over the radio link.

This ensures a secured data transfer and unauthorised use.

SMS (Short Message Service)

The GSM modems offer the possibility to send a text message of up to 160 characters to any equipment that can handle SMS.

The GSM modems has the feature to be able to send pre-programmed SMS to one specific phone number if the DTR input are triggered.

It could be used as an alarm indicator from e.g. a PLC to a service technician's cellular phone indicating that some faults occured in the system.
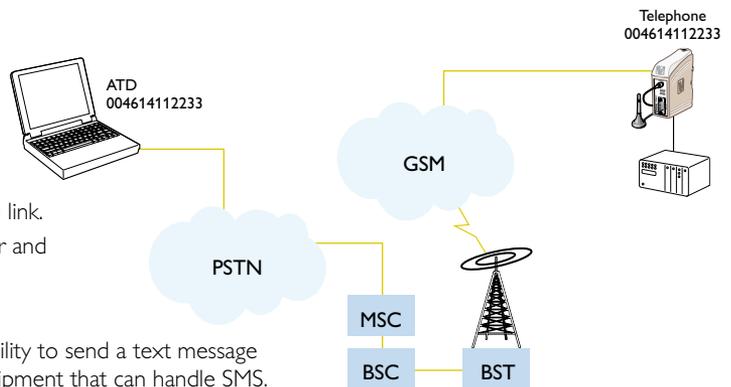
GPRS

GPRS is an extension of GSM network where packet switching data traffic is supported. With GPRS each channel that is not busy with call traffic is available for packet switching data traffic. Packets from several different users can be mixed within the same channel, which results in efficient sharing of available network resources.

GPRS permits even higher transfer rates as it uses several time slots for the transfer. In theory rates of up to 115.2 kbit/s can be achieved, however, transfer rates of between 20 – 50 kbit/s are more common. Transfer rate is however dependent on several factors and some of them are: operator, terminal, number of users on the same cell, distance to the base radio station (re-transmissions).

### Establish a GPRS Connection

Communication with GPRS uses another procedure. GPRS is based on IP communication and the connected unit must provide an IP address before a connection can be established.

This is done by:

- Connecting to the GPRS network.
- A dynamic address is assigned.
- The exchange of data can take place.

1. GPRS attached
2. Dynamic IP addresses alloted
3. Transmitted/Received data
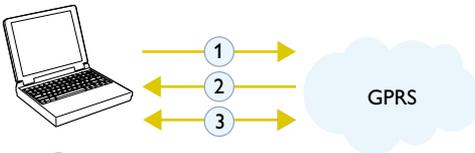
1. GPRS attached
2. Dynamic IP addresses alloted
3. Transmitted/Received data
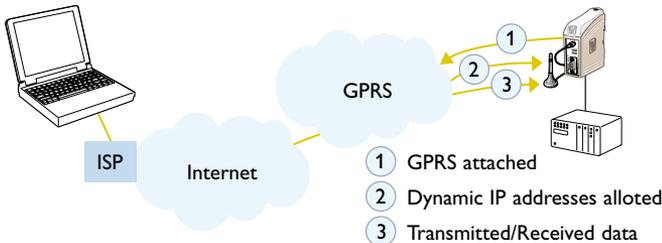
Not all operators can offer subscriptions with static address allocation. With dynamic allocation, you do know from instance to instance which address has been assigned to the opposing equipment. This is not a problem if the GPRS modem initiate a connection to the master. The modem will get a dynamic IP-address after a GPRS attached and can then connect to some equipment that has a fixed IP-address, for example, a computer.

The problem occurs when a unit, for example, a computer wants to communicate with peripheral equipment and the computer generates the connections. No one knows the IP-address that the computer should connect to, as these are assigned dynamically.
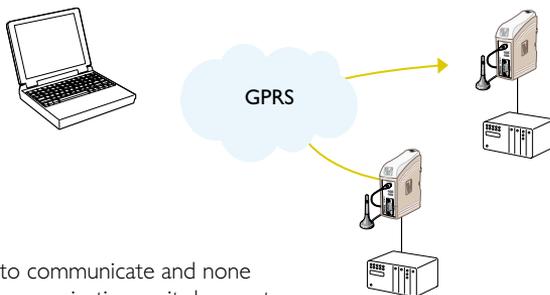
The same problem occurs when two devices need to communicate and none of them are master. The modem cannot initiate IP-communication, as it does not know which IP-address will be assigned.
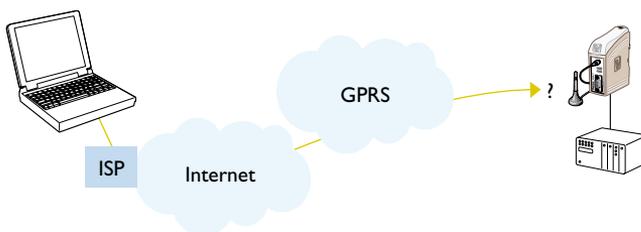
This is however not a problem if all devices could be assigned a fixed IP-address.

Reliable Radio Transmission

The GDW-Tool has a very useful feature when it comes to installation of the system with an antenna to make reliable connections. This is a test that can be carried out without any SIM-card fitted into the modem.

Not only will you see the signal strength of several local cell sites, but also the actual name of the network provider as well as the ID-number of that specific radio connection. If the signal strengths are not sufficient then different types of antenna can be used to achieve a reliable connection or a different service provider can be used.

Antennas

A whip antenna is the most common example of a monopole antenna, an antenna with a single driven element and a ground plane.
The whip antenna radiate equally in all directions in a horizontal plane, although they have a conical blind zone directly above them.

A whip antenna is not to be recommended in public installations. It could be more suitable to mount a more discreet antenna, which is not so easy to break or to be vandalised (Low profile).

In mobile applications is it suitable to have omni directional antennas (Dipole) to achieve higher reliable transmission.

If there is a stationary installation and the signal strength is not enough is it possible to use directional antennas (Yagi). In point-to-point, fixed radio networks, it is always highly recommended to use directional antennas when applicable.

This is because of better control over the system and closed construction; the signal is forced and noise collected only to and from the relevant directions.

Example of
Dipole aerial
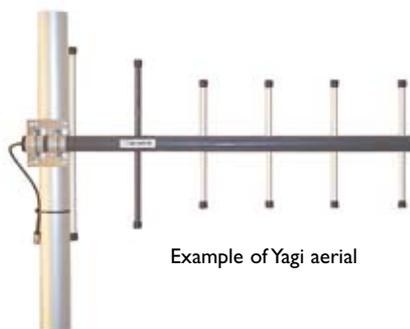
Example of Yagi aerial
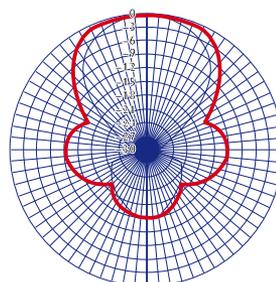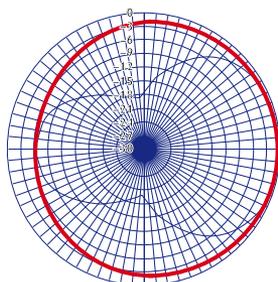
Radiation patterns for omni directional antennas (left; Dipole) and directional antennas (right; Yagi).

GSM modem
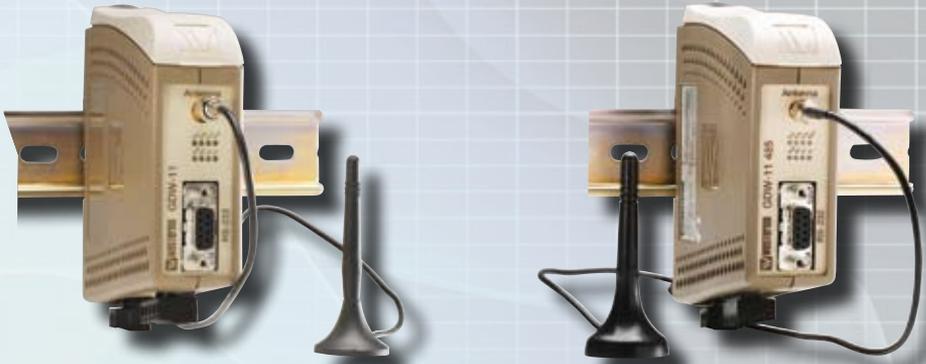
GSM modem for US market

- GSM 900/1800 MHz
- Extended temperature range –25°C to +50°C (–13 to –122°F)
- GPRS, class B, class 10
- DTR triggered -dialling and SMS
- Up to 11 data bits
- 8 x LED indicators
- Speed CSD up to 14.4 kbit/s, GPRS up to 85.6 kbit/s
- Speed serial: 300 to 115.2 kbit/s
- Galvanic isolation for power supply
- TCP/IP Stack

GDW-11
GSM modem

The GDW-11 is a GSM/GPRS modem designed for industrial applications that can be used on 900 and 1800 MHz GSM networks. The modem requires a SIM card to provide connection to a network service provider.

The modem contains an enhanced TCP/IP stack to allow GPRS (**G**eneral **P**acket **R**adio **S**ervice) connections to be made seamlessly and reliably ensuring maximum availability of the GPRS connection. If the GPRS connection is broken the modem can automatically re-establish the link.

Another enhanced feature in the modem includes the ability to make a CSD connection or send an SMS message when the DTR signal is activated, allowing the modem to be used in applications where the connected device has no intelligence to initiate a call using AT commands.

If a PIN number is used by the network, this can be stored in the modem to ensure the availability of the modem after a power failure. The modem can also periodically re-register with the network, this is required as some networks will deregister a SIM that has not moved or been active for a period of time.

GDW-11 485
GSM modem

The GDW-11 485 is a GSM/GPRS modem designed for industrial applications that can be used on 900 and 1800 MHz GSM networks. The modem requires a SIM card to provide connection to a network service provider.

As well as a standard RS-232 port the GDW-111 485 has an RS-422/485 interface allowing multidrop connections to many types of industrial equipment.

The modem contains an enhanced TCP/IP stack to allow GPRS (**G**eneral **P**acket **R**adio **S**ervice) connections to be made seamlessly and reliably ensuring maximum availability of the GPRS connection. If the GPRS connection is broken the modem can automatically re-establish the link.

Another enhanced feature in the modem includes the ability to make a CSD connection or send an SMS message when the DTR signal is activated, allowing the modem to be used in applications where the connected device has no intelligence to initiate a call using AT commands.

If a PIN number is used by the network, this can be stored in the modem to ensure the availability of the modem after a power failure. The modem can also periodically re-register with the network, this is required as some networks will deregister a SIM that has not moved or been active for a period of time.

- GSM 900/1800 MHz
- Extended temperature range −25°C to +50°C (−13 to −122°F)
- GPRS, class B, class 10
- DTR triggered -dialling and SMS
- Up to 11 data bits
- 8 x LED indicators
- Speed CSD up to 14.4 kbit/s, GPRS up to 85.6 kbit/s
- Speed serial: 300 to 115.2 kbit/s
- Galvanic isolation for power supply
- TCP/IP Stack
- RS-232 / RS-422 / RS-485 interface

Intranet Company LAN
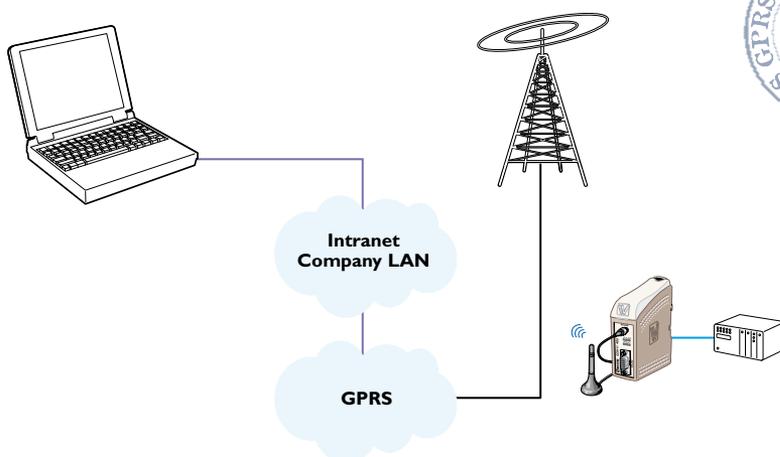
GPRS

- GSM 850/1900 MHz
- UL approved
- Extended tempe-rature range
- –13 to –122°F (–25°C to +50°C)
- GPRS, class B, class 10
- Built in TCP/IP
- DTR-dialling
- DTR-SMS
- SMS-message up to 160 characters
- Up to 11 data bits
- Speed CSD up to 14.4 kbit/s, GPRS
- up to 85.6 kbit/s
- Speed serial: 300 to 115.2 kbit/s
- Galvanic isolation on power supply

GD-01US
Cellular/GSM-modem

GD-01 US is a Cellular/GSM modem designed for industrial applications and can be used on GSM networks in 850 or 1900 MHz band.

Equipment with an RS-232 interface can be connected and data rates of up to 14.4 kbit/s in CSD and 85.6 kbit/s in GPRS are possible. Wireless commu-nication means immense flexibility and the possibility to control, monitor and inspect equipment, when communications were not possible before for one reason or another. One condition is, however, that it occurs within the coverage area of a GSM network operator. SMS-messages of up to 160 characters can also be sent.

A message can be sent to a pre-programmed number by activating the modem using an external signal (DTR). This makes the modem ideal, for example, to transmit a common alarm from an unmanned station. GD-01 US can com-municate with other GSM modems, GSM wireless phones, traditional analogue modems (TD-xx) as well as ISDN-adapters (ID-xx). The modem is configured using AT-commands.
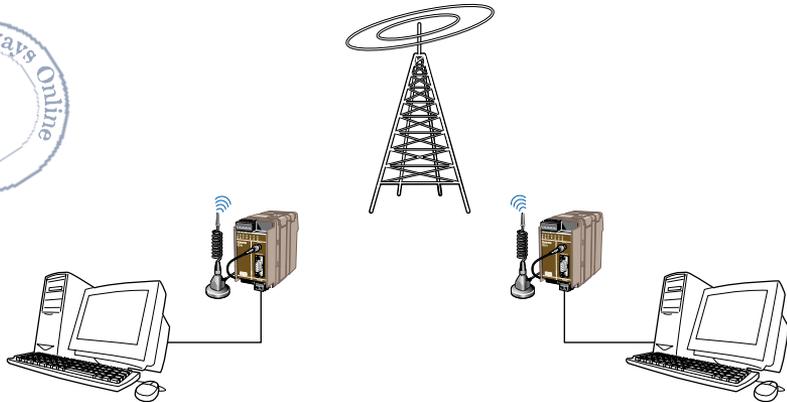
Technical Data

Power	
Rated voltage	12 to 36 VDC
Operating voltage	10.8 to 39.6 VDC
Rated current	**GDW-11** 350 mA @ 12 VDC 150 mA @ 24 VDC 75 mA @ 48 VDC **GD-01 US** 350 mA @ 12 VDC 150 mA @ 24 VDC 117 mA @ 36 VDC
Rated frequency	DC: 0 Hz AC: 48 to 62 Hz
Inrush current I^2t	0.05 A^2s
Startup current*	0.75 A_{peak}
Polarity	Reverse polarity protected / GDW-11 is polarity independent
Isolation to	All other ports 3 kV$_{rms}$ 50 Hz 1 min
Connection	Detachable screw terminal
Connector size	0.2 – 2.5 mm^2 (AWG 24-12)
Shielded cable	Not required

* External supply current capability for proper startup

RS-232	
Electrical specification	EIA/TIA-232
Data rate	300 bit/s – 115.2 kbit/s
Data format	7 or 8 data bits, odd, even or none parity, 1 or 2 stop bits. 9–11 bit words
Protocol	Transparent
Re-timing	Yes
Transmission range	Cable length ≤ 15 m
Isolation to	Power port 3 kV$_{rms}$ 50 Hz 1 min
Connection	9-pin D-sub female (DCE) and Detachable screw terminal (DCE)
Connector size	0.2 – 2.5 mm^2 (AWG 24 – 12)
Shielded cable	Not required*
Miscellaneous	**GDW-11 485** Do not connect RS-232 and RS-422/485 simultaneously

RS-422/485 GDW-11 485	
Electrical specification	EIA/TIA-485 ITU V.11 2-wire or 4-wire twisted pair
Data rate	1200 bit/s – 115.2 kbit/s
Data format	7 or 8 data bits, odd, even or none parity, 1 or 2 stop bits. 9–11 bit words
Protocol	Transparent
Re-timing	Yes
Turn around time	≤ 10 µs (half duplex)
Transmission range	≤ 1200 m, depending on data rate and cable type (EIA RS-485)
Settings	120 Ω termination and failsafe biasing 680 Ω
Isolation to	power port 3 kV$_{rms}$ 50 Hz 1 min
Protection	Installation Fault Tolerant (up to ±60 V)
Connection	Detachable screw terminal
Connector size	0.2 – 2.5 mm^2 (AWG 24 – 12)
Shielded cable	Not required*
Miscellaneous	Do not connect RS-232 and RS-422/485 simultaneously

* Railway installation close to the rails.
For a cable located within 3 m and connected to this port, the use of shielded cable is recommended, this is to minimise the risk of interference. The cable shield should be properly connected (360°) to an earthing point within 1 m of this port. This earthing point should have a low impedance connection to the conductive enclosure of the apparatus cabinet, or similar, where the unit is built-in. This conductive enclosure should be connected to the earthing system of an installation and may be directly connected to the protective earth.

Type tests and environmental conditions

| Electromagnetic Compatibility			
Phenomena	**Test**	**Description**	**Level**
ESD	EN 61000-4-2	Enclosure contact	± 6 kV
		Enclosure air	± 8 kV
RF field AM modulated	IEC 61000-4-3	Enclosure	10 V/m 80% AM (1 kHz), 80 – 1000 MHz 20 V/m 80% AM (1 kHz), 80 – 2000 MHz
RF field 900 MHz	ENV 50204	Enclosure	20 V/m pulse modulated 200 Hz, 900 ± 5 MHz
Fast transient	EN 61000-4-4	Signal ports	± 2 kV
		Power ports	± 2 kV
Surge	EN 61000-4-5	Signal ports unbalanced	± 2 kV line to earth, ± 2 kV line to line
		Signal ports balanced	± 2 kV line to earth, ± 1 kV line to line
		Power ports	± 2 kV line to earth, ± 2 kV line to line
RF conducted	EN 61000-4-6	Signal ports	10 V 80% AM (1 kHz), 0.15 – 80 MHz
		Power ports	10 V 80% AM (1 kHz), 0.15 – 80 MHz
Power frequency magnetic field	EN 61000-4-8	Enclosure	100 A/m, 50 Hz, 16.7 Hz & 0 Hz
Pulse Magnetic field	EN 61000-4-9	Enclosure	300 A/m, 6.4 / 16 µs pulse
Voltage dips and interruption	EN 61000-4-11	AC power ports	10 & 5 000 ms, interruption 10 & 500 ms, 30% reduction 100 & 1 000 ms, 60% reduction
Mains freq. 50 Hz	EN 61000-4-16	Signal ports	100 V 50 Hz line to earth
Mains freq. 50 Hz	SS 436 15 03	Signal ports	250 V 50 Hz line to line
Voltage dips and interruption	EN 61000-4-29	DC power ports	10 & 100 ms, interruption 10 ms, 30% reduction 10 ms, 60% reduction +20% above & −20% below rated voltage
Radiated emission	EN 55022	Enclosure	Class B
	FCC part 15		Class B
Conducted emission	EN 55022	AC power ports	Class B
	FCC part 15	AC power ports	Class B
	EN 55022	DC power ports	Class B
Dielectric strength	EN 60950	Signal port to all other isolated ports	2 kVrms 50 Hz 1min
		Power port to other isolated ports	3 kVrms 50 Hz 1min 2 kVrms 50 Hz 1min (@ rated power < 60V)
Environmental			
Temperature		Operating	−25 to +50°C
		Storage & Transport	**GDW-11** −30 to +85°C **GD-01 US** −25 to +70°C
Humidity		Operating	5 to 95% relative humidity non condensing
		Storage & Transport	5 to 95% relative humidity non condensing
Altitude		Operating	2 000 m / 70 kPa
Reliability prediction (MTBF)	MIL-HDBK- 217F	Operating	
Service life		Operating	10 year
Vibration	IEC 60068-2-6	Operating	7.5 mm, 5 – 8 Hz 2 g, 8 – 500 Hz
Shock	IEC 60068-2-27	Operating	15 g, 11 ms
Packaging			
Enclosure	UL 94	PC / ABS	Flammability class V-1
Dimension W x H x D			**GDW-11** 35 x 121 x 119 mm **GD-01 US** 55 x 100 x 128 mm
Weight			**GDW-11** 0.2 kg **GD-01 US** 0.3 kg
Degree of protection			**GDW-11** IP 21 **GD-01 US** IP 20
Cooling	IEC 529	Enclosure	Convection
Mounting			Horizontal on 35 mm DIN-rail

Accessories

3615-0001	GDW-11	900 / 1 800 MHz, Data, Fax, SMS, TCP/IP, RS-232
3615-0030	GDW-11 / 485	900 / 1 800 MHz, Data, Fax, SMS, TCP/IP, RS-485
3196-0020	GD-01US	850 / 1 900 MHz, Data, Fax, SMS, TCP/IP, RS-232, UL approved
3193-9048	Aerial EX07	Whip Aerial with Magnetic Mounting Foot, 2.5 metre cable, 900 / 1800 MHz
3195-9008	Aerial M70EXR	Low Profile Aerial, 2.5 m cable, 900 / 1800 MHz
3193-9041	Aerial CA930D	Dipole Aerial, Gain 4 dBi, 900 MHz
3193-9042	Aerial CA930Y	Yagi Aerial, Gain 6 dBi, 900 MHz
3193-9043	Aerial CA930Y+	Yagi Aerial, Gain 8 dBi, 900 MHz
3193-9044	Aerial CA930Y++	Yagi Aerial, Gain 10 dBi, 900 MHz
3195-9020	Cable, Extension	3 metre extension cable between modem and Yagi / Dipole Aerial
3195-9021	Cable, Extension	5 metre extension cable between modem and Yagi / Dipole Aerial
3195-9022	Cable, Extension	10 metre extension cable between modem and Yagi / Dipole Aerial
3195-9010	Cable, Extension	3 metre extension cable between aerial M70EXR / EX07 and modem
3195-9011	Cable, Extension	5 metre extension cable between aerial M70EXR / EX07 and modem
3195-9012	Cable, Extension	10 metre extension cable between aerial M70EXR / EX07 and modem
3129-0011	PS-12	Power Supply to GDW-11 and GD-01 US, 230 V AC to 12 VDC 800 mA
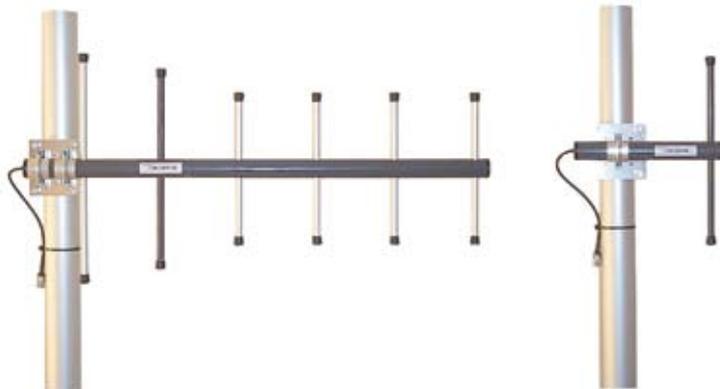
Note! The whip aerial EX07 is included in 3615-0001, 3615-0030 and 3196-0020.

Westermo your only provider of Industrial Data Communications!

Westermo offers a very wide product range, please visit our website for more detailed information.

WV westermo®

H E A D   O F F I C E

Sweden
Westermo Teleindustri AB
SE-640 40 Stora Sundby, Sweden
Phone: +46 (0)16 42 80 00
Fax: +46 (0)16 42 80 01
info@westermo.se
www.westermo.com

S U B S I D I A R I E S

Sweden

Westermo Data Communications AB
Svalgången 1, Vallbyinstitutet
SE-724 81 Västerås, Sweden
Phone: +46 (0)16 42 80 00
Fax: +46 (0)21 35 18 50
info.sverige@westermo.se
www.westermo.se

United Kingdom

Westermo Data Communications Ltd
Talisman Business Centre
Duncan Road, Park Gate, Southampton. SO31 7GA
Phone: +44(0)1489 580 585
Fax: +44(0)1489 580 586
sales@westermo.co.uk
www.westermo.co.uk

Germany

Westermo Data Communications GmbH
Goethe Strasse 67
DE-68753 Waghäusel. Germany
Tel: +49(0)7254 95400-0
Fax: +49(0)7254-95400-9
info@westermo.de
www.westermo.de

France

Westermo Data Communications S.A.R.L.
Bat. A, 9 Chemin de Chilly
FR-91160 Champlan. France
Tél : +33 1 69 10 21 00
Fax : +33 1 69 10 21 01
infos@westermo.fr
www.westermo.fr

Norway

Westermo OnTime AS
Gladsvei 20 0489 Oslo, Norway
Phone +47 220 903 03
Fax +47 220 903 10
E-mail: contact@ontimenet.com

Singapore

Westermo Data Communications Pte Ltd
2 Soon Wing Road #08-05
Soon Wing Industrial Building
Singapore 347893
Phone +65 6743 9801
Fax +65 6745 0670
E-mail: earnestphua@westermo.com.sg
www.westermo.com

REV 1.1-2007-10

AUDIN - 8, avenue de la malle - 51370 Saint Brice Courcelles
Tel : 03.26.04.20.21 - Fax : 03.26.04.28.20 - Web : http: www.audin.fr - Email : info@audin.fr