WIRELESS, RUGGED, WEATHERPROOF SOLAR TRACKING DEVICE

The G52 Solar's rugged housing and built in solar panel allows the device to monitor and track assets in harsh and remote environments, without the need for an external power source. This compact 2G or 3G (NextG) GPS tracking device provides telemetry using the power of the sun.

1. PRODUCT VARIANTS

The following product variants are available:

| Product Code	Description
G52S-2G	G52 Solar with 2G GSM modem*
G52S-3GE	G52 Solar with 3G EU modem*
G52S-HARN8-3M	8 wire 3 metre harness for the G52S

*see the modem section below for more information on the modem variations. Contact DM for other modem models.

2. G52S HARDWARE FEATURES

Hardware Features	
Compact Rugged Housing	IP67 rated housing UV resistant nylon glass composite housing Dimensions: L 126 mm x W 80 mm x H 33 mm Weight: 160 grams (complete unit)
Solar Panel	Power output: 0.3 W peak Current output: Approximately 50 mA peak, depending on battery voltage
Connector	9 pin IP67 rated connector Multiple harnessing options can expose power, ground, ignition, input, output, CAN, and SDI-12. See the G52S user manual for connector pin details.

External Power	**Input Voltage**	9V to 24V DC
		Absolute maximum of 45 V DC, but it is not recommended to exceed 24 V for thermal reasons.
	Input Current	Trickle charge at < 100 mA
Internal Battery	High temperature Lithium Polymer 800 mAh battery Battery operating time depends on operating mode	
Operating Temperature	-20°C to +60°C battery discharge only 0°C to +60°C battery charge Below 0°C the standard internal backup battery's ability to deliver sufficient power to operate the cellular modem is reduced. Below 0°C and above +60°C the internal backup battery will not be charged as a safety precaution due to dangers associated with charging batteries at extreme temperatures. For battery powered tracking in extreme temperatures enquire about the Digital Matter Remora tracker with extended temperature range battery options.	
High Sensitivity GPS	UBLOX MAX7Q GPS module Supports GLONASS and other GNSS systems 56 channel high sensitivity receiver -161dBm industry leading tracking performance Battery backed up for optimal hot-start performance AssistNow Offline aiding data for extremely fast time-to-first-fix and performance in urban canyon environments	
Low Noise GPS amplifier	GPS signals are boosted by a special low-noise amplifier (LNA) This allows the G52S to operate where normal units will fail to receive GPS signal	
2G or 3G (NextG)	The G52S can be manufactured for specific markets around the world with cellular modem modules approved by all the major networks	
	2G Modem	Quad Band GSM/GPRS Class 10 850 / 900 / 1800 / 1900 MHz
	3G Modem – EU	850 / 900 / 2100 EMEA / APAC / Latin America
	3G Modem - NA	850 / 1900 / AWS North America
	3G Modem (Global Option)	800 / 850 / 900 / AWS / 1900 / 2100 Global coverage at a higher cost
	*enquire for other bands and LTE / 4G options	
Certifications	ICASA: TA-2013/1921 CE: Declaration of conformity with relevant test reports C-TICK: Declaration of conformity with relevant test reports	
Internal Antennae	Internal GPS and cellular antennae Having the primary antennae inside the housing makes for simple	

	and quick installation. The G100 has had its antennae tuned by a top laboratory to ensure optimal performance.
2 x Digital Inputs	1 x ignition line with configurable pull-up / pull-down 1 x digital inputs permanently pulled down (SDI-12 compatible)
1 x Digital Outputs	1 x switched ground digital output, easily wired up to switch external lights, relays, buzzers, sirens, motors and other devices
3 Axis Accelerometer	The 3 axis accelerometer allows the G52S to detect movement and impacts. It allows the G52S to go to 'sleep' when not moving, resulting in extremely low standby current.
Switched 5V Output	The G52S can provide power to external peripherals via this 5V power line, allowing sensors and peripheral devices to be powered. Maximum current: 300 mA
DMCAN Peripheral Port	Digital Matter has the ability to connect a range of peripherals via the DMCAN peripheral port. Peripherals such as the AgriCAN expansion board can be used with the G52S.
Flash Memory	The G52S has sufficient memory to store over 25,000 records in its flash memory. Normally the data will be sent to the server immediately but if the device is out of range then there is sufficient space to ensure that no data is lost – for many weeks of recording. The flash memory is also used to store parameters, GPS aiding data, firmware updates and other important information that needs to be securely stored.
SDI-12 interface	The 5V output and digital input can be used as an SDI-12 interface, allowing the use of a variety of sensors. Commonly used sensors include: soil moisture probes, flow meters, humidity sensors.
Intrinsically Safe Rating	EX ia IIC T4 The G52S is rated by MASC in South Africa for use in group IIC gases, which is the most severe grouping. Enquire with DM about this version
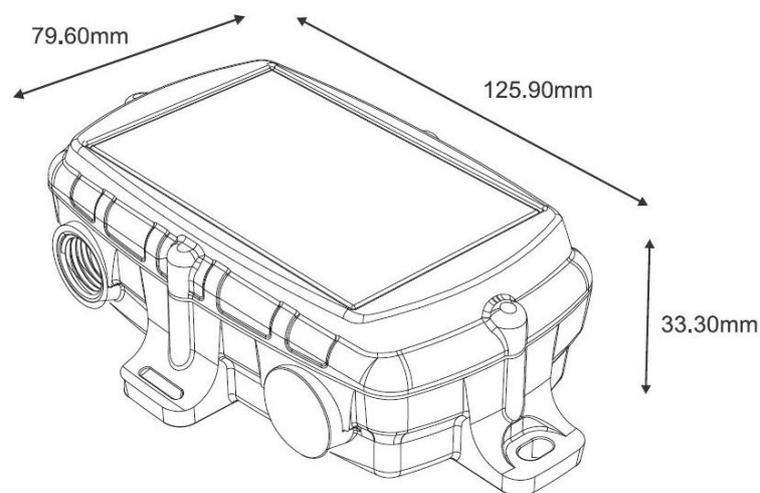
3.   G52S FIRMWARE FEATURES

3.1. Agriculture or Tracking Firmware

The G52S has two distinct applications that require different firmware: Agricultural Telematics and GPS Tracking. The hardware is identical for both applications, and the firmware can be switched over the air. This following sections describe features of the firmware that apply to Agricultural Telematics, GPS Tracking, and both versions.

3.2. General Features

The following features are available in both Agricultural and GPS tracking firmware versions.

General Firmware Smarts	
Auto-APN	Auto-APN allows the G52S to analyse the SIM card and select the correct APN details from a list that is pre-loaded in the device's firmware. This means that the G52S can be shipped world-wide without requiring specialist setup for SIMs.
Text Message Setup	The G52S can also be sent text messages to setup the APN, server and other details
Multi-APN	The G52S can be configured to roam across multiple networks and to automatically use the different APN details for the roaming networks.
AssistNow Offline	The G52S will track successfully where other devices just give up. This fantastic technology allows the GPS to predict which satellites are in orbit above it and to dramatically reduce the time-to-first-fix of the GPS, and the overall performance of the GPS, especially in 'urban canyon' or forested environments.
Deep power down	The G52S will enter an extremely low power state when the battery is low (below 3.5 V). This maximises the potential for the battery to be charged by the solar panel. The device will do a low power wake-up every hour to check the battery status. If the battery is charged sufficiently (above 3.5 V), the device will do a full wakeup and continue with normal operation
Power bands	The G52S must work in power constrained environment. The firmware has built in power bands to adjust the behaviour according to how much power is available. The battery capacity is divided into thirds. Different behaviour can be assigned to each third. This provides a flexible setup that maximises the usefulness under different power conditions. See the user manual for more information.
Battery protection	The Li-Po battery is sensitive to overcharging and charging out of the temperature specification. The charge rate is very low (1/16C). The device employs a shunt strategy to divert energy away from the battery when the battery should not be charged. G52S devices have been operating successfully in harsh environments for over two years.

3.3. Agricultural Telematics Features

The following features are available in the Agricultural firmware version.

Agricultural Firmware Smarts	
SDI-12 interface	Connect SDI-12 sensors using the 5V output, input 1, and ground connections. Connect up to 10 sensors with unique configurable addresses. SDI-12 interface is 3.3V compatible.
Rain gauge	Connect a tipping rain gauge to the ignition input. The ignition input is configurable to pull up internally.
Sensor timing	Configure the G52S to take readings at set intervals, aligned with the hour. For example, by default it will take SDI-12 readings every 15 min, starting on the hour.
Upload timing	Schedule uploads to suit the latency or data bill. Data is stored in the flash until it is uploaded.
GPS fix timing	Schedule GPS fixes as required. The default setting updates the device position once per day.
Telemetry	Understand the status of the G52S with the following recorded data: battery level, external power, temperature, GSM signal strength, and solar panel input voltage

3.4. GPS Tracking Features

The following features are available in the Agricultural firmware version.

GPS Tracking Firmware Smarts	
Emulated Ignition	Emulated Ignition allows the G52S to determine that a trip has started based on accelerometer and GPS data and to automatically set the 'ignition' input on the device to emulate the ignition line. This means that the G52S can be installed with the option of not wiring in the ignition line and 'emulating' the ignition based on movement. Trips are started using a configurable distance and speed threshold. Trips are ended using a configurable stationary period.
Assumed Start Point	Once an emulated ignition (movement) trip has started, the device will calculate a sensible start point. This give more accurate trip reproduction.
Wired Ignition	Use the ignition wire to start and stop trips. Accurately monitor engine run hours this way.
Run Detect	This setting allows the G52S to monitor the system voltage and to detect changes in the voltage that indicate if the engine is running or not.
In Trip Time Based Logging	Once the device has determined that a trip has started, GPS logging is done on a configurable time period. The period is configurable in each power band.

Periodic Only Logging	The device can be configured to ignore trips and only log on a periodic basis. For example, use this to get a GPS point every hour, regardless of movement.
Accident Detection	The G52S uses the built-in accelerometer to detect high G impacts such as accidents and rollovers and reports these events to the server for emergency alerting.

4. COMMON USE CASES

The G52S finds many areas of use:

- **Agriculture:**
    - o Soil moisture: collect data remotely via the SDI-12 interface
    - o Rain gauge: connect a tipping rain gauge using the ignition input
    - o Pump control: control a pump remotely using the switched ground output
- **Weather station:**
    - o Connect a variety of sensors using the SDI-12 input: relative humidity, temperature, wind speed and direction.
- **Unpowered asset tracking:**
    - o Portable toilets
    - o Lighting rigs
    - o Containers
    - o Rail cars
- **Hazardous material tracking:**
    - o Track hazardous materials with the G52S intrinsically safe version
- **Backup tracker:**
    - o Install a stand-alone wireless tracker as a backup in SVR applications

5. POWER MANAGEMENT

The G52S operates with power constraints. The operating configuration should not use more power than is available from the solar panel. Determining the optimal configuration is a combination of calculation and testing. The default behaviours give an idea of what is possible. In areas with more solar energy available, more aggressive configurations are possible.

All configurations are adjustable Over-The-Air using system parameters.

The default configuration for the Agricultural Firmware:

Battery level	GPS fix period	Upload period	SDI-12 reading & AgriCAN* Temp reading period	Cameras Enabled*
0-33% (3.5-3.7 V)	12 hr	6 hr	1 hr	No
33-66% (3.7-3.85 V)	12 hr	1 hr	15 min	Yes
66-100% (3.85-4.1V)	12 hr	1 hr	15 min	Yes

* For information on the AgriCAN and Cameras, contact DM

The default configuration for the GPS Tracking Firmware:

Battery level	In trip		Out of trip	
	GPS log period	Upload period	GPS log period	Upload period
0-33% (3.5-3.7 V)	5 min	60 min	6 hrs	24 hrs
33-66% (3.7-3.85 V)	1 min	15 min	3 hrs	12 hrs
66-100% (3.85-4.1 V)	30 sec	15 min	1 hrs	12 hrs

6. DEVICE MANAGEMENT – OEM SERVER

All Digital Matter devices are fully managed Over-The-Air (OTA) via our OEM Server web interface. The OEM Server seamlessly manages:

- Device firmware – firmware updates can be done remotely

- Network (administrator) parameters relating to critical communications

- System parameters, including GPS parameters, IO configuration, logging options and general device behaviour settings

- GPS AssistNow Offline aiding data files

- Remote debugging of devices, including being able to trace data, view detailed debug message logs, and view a live trace of the server debug messages

- Remote disconnect and reboot of devices

- Geo-fence syncing with the devices – this allows the device to do advanced in-cab alerting and monitoring such as geo-fence arrival and departure, speed limit alerting, dangerous intersection warnings, turn on warning lights inside a geo-fence, and disable communications inside intrinsically safe zones such as gas plants.

- Provides a command and message queueing platform to the devices and is incorporated into the remote management and debugging applications

Data Connectors

The OEM Server provides Data Connectors that forward data records on to the software platform of your choice, including Digital Matter's own Telematics Guru and GPS Log Book platforms.

More information on the OEM Server can be found at http://www.digitalmatter.com.au

If you would like to integrate the G52S into a software system then please contact Digital Matter for more information on our integration protocols.

7. CONTACT INFORMATION

For the latest version of this document plus other product information please visit our website at www.digitalmatter.com.au