BEAM　　　BMeasure-gui Manual

Product	BMeasure-125i
Manual Version	1.1.1
Hardware Version	1.4.0
Software version	1.1.1
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1. Contents

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2. Introduction

The Beam BMeasure-125i unit is a flexible and powerful measuring system for data capture, data logging and control in the laboratory, industrial and remote sensing arenas. It is based around an 8 channel, fully differential, synchronous sampling, 24 bit ADC that can sample at speeds up to 128 ksps. Multiple units can be connected together to provide more synchronously sampled channels.

Operating as a data capture unit the system can capture the data from 8 analogue and 8 digital channels to a host computer over the USB, Ethernet, Wifi or RS-485 interfaces. Operating as a data logger, the system can autonomously sample and store the data to internal non-volatile FLASH storage or external Micro SDCARD for later data retrieval.

Data can be scaled and offset to floating point values with channel names and measurement units configured. The system is also able to perform a degree of processing on the raw sample data stream. This includes calculating the RMS, Mean, PeakHigh and PeakLow values for all of the channels over a set time period. Alarms can be triggered when a channels value goes out of range.

The unit is low power and has flexible power supply inputs. Options include 5-24V DC input, USB-5V, power over Ethernet and battery operation for remote monitoring applications. A 3G/4G mobile communication option is also available for such remote sensing applications (Contact us for more information).

IoT MQTT direct cloud access via the Internet is a configurable feature. The system also supports custom on-board programs allowing the unit to perform autonomous control functions for many uses. Please contact us for further information.

The unit can be configured to capture signals at up to 128 ksps. This is useful for acoustic, vibration and general electronic signal capture. It can also sample down to 1 sample per day for lower speed measurements such as temperature, humidity or other similar slow changing parameters.

This manual describes the operation of the bmeasure-gui program that runs on a suitable host computer system and communicates with the BMeasure-125i over an USB, Ethernet or other physical interface.

3. Host Programs

The BMeasure-125i can be configured and operated over its USB or Ethernet network interfaces from a host computer. We provide a host software package for Linux and Microsoft Windows platforms for this purpose. The BMeasure-125i user manual provides more information.

This manual covers the usage of the bmeasure-gui program which is a graphical configuration and operation program for one or more BMeasure-125i units.

4. Basic Usage

Once the bmeasure-gui program is started it presents a set of TAB's for the main operational areas. The first TAB show provides status information on the unit or units connected.

The first thing a user needs to do is connect to one or more BMeasure-125i units. This is done in the Units TAB. You can use the find functionality to search for BMeasure units or manually enter their connection information. You can save this connection information if wanted. The "C" button on the tool-bar now provides a connection toggle button.

Once connected you can set up a measurements parameters in the "Config/Measurement Config" TAB. The programs tool-bar provides controls for the most often used of these parameters.

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The green run arrow starts the measurement going and the red square stops the measurement if not set to automatically stop.

The Graphs TAB shows the data captured from the channels.

The rest of this manual details the operations of the various aspects of the bmeasure-gui program.

5. BMeasure Status

The Status TAB displays the status of the master BMeasure-125i unit that the BMeasure-gui application is connected to. This includes the current running status, the units current time and the network configuration.

6. Units Configuration

The BMeasure-gui application can connect to one or more BMeasure units simultaneously. When connected to multiple units they are assumed to be connected together with a synchronisation cable and will run as a single, synchronised data acquisition system. There is a "Multi connect" checkbox to enable this feature.

The Units TAB displays the list of found or manually entered BMeasure units. The "Find units" button will scan the host's USB devices and the local network for BMeasure units. Those found will be added to the list of units.

Units can be added manually using the "Manual add unit" button. The BMeasure units are selected using a URL type of string. For USB units this has the format "boapu://<serial number>" for network units it has the format "boapn://<host or IP address>".

The "Enable" checkbox is used to select which set of units to connect to. The top most unit will be the master unit when multiple units are connected in a synchronised set. The "Up" and "Down" buttons allow units to be moved up and down in the synchronous set of units.

The "Connect/Disconnect" button connects or disconnects the bmeasure-gui from the selected BMeasure units. The bmeasure-gui's toolbar's "C" Connect button will also connect/disconnect from the enabled units.

The "Clear" button clears the list of Units. Whilst the "Save" button saves the settings for the next program run. If the "Auto Connect" checkbox button is checked and the settings saved then the BMeasure-gui application will automatically connect to the configured units at startup

7. Measurement Configuration

This configuration page allows the measurement configuration to be set for live data captures as well as the autonomous run mode. It has the following parameters that can be configured:

- **Measure Mode:** This sets the overall measurement mode. It can be one of the following:

    ○ **One Shot:** Captures a single set of samples defined by the smallest of the "Chunk Duration" or "Capture Duration" parameters and after the trigger if this is configured.

    ○ **Repeat:** This performs multiple One Shot data captures of "Chunk Duration" triggering at the start of each separate capture if triggering is configured. If the "Repeat Period" parameter is non zero, then the system will wait this number of seconds between each capture.

    ○ **Continuous:** Captures samples continuously until the number of samples in "Capture Duration" have been sampled. If "Capture duration" is 0 then the unit will continuously capture until stopped. The unit will display "Chunk Duration" samples at a time in graph displays. Triggering, if set, will only occur at the start of the continuous capture.

- **Trigger Mode:** This enables triggering and the selection of a positive or negative going trigger.

- **Trigger Channel:** This defines the channel number to trigger from.

- **Trigger Level:** The signal level at which the trigger will occur. Set this to 0.5 for digital channels.

- **Trigger Delay:** The delay after the trigger event to start capturing and perhaps storing data.

- **Sample Rate:** The sample rate.

- **Chunk Duration:** Duration of each chunk captured and displayed. This can be entered as the number of samples or a time.

- **Capture Duration:** In Repeat or Continuous modes this defines to total number of samples to be captured. This can be entered as the number of samples or a time.

- **Repeat Period:** In repeat mode this sets the time, in seconds, between each repeated capture of a set of samples.

- **Data Processing:** When enabled the unit will calculate the RMS, Mean, PeakHigh, PeakLow and possibly the Power values of the raw data samples. These will be calculated over the period as defined in the "Data Process Duration" parameter. The results can be displayed or saved to a file.

- **Data Process Duration:** When data processing is enabled, the raw data samples are processed over the process duration period and will yield a set of processed data sample. The fastest rate supported is 10Hz. The resulting processed data samples can be displayed (in the Processed TAB) and/or saved to a file.

- **Description:** This provides the ability to enter a short description for the measurement that will be stored in the data files.

There are three buttons that are used to set different standard configurations:

- **Set fast raw data mode:** This sets the sampling rate to 128000 SPS and performs a one shot data capture of 1000 samples.

- **Set processed data mode:** This sets the sampling rate to 1000 SPS and performs a one shot data capture of 1000 samples processing them to yield one set of processed data samples. So 1 second overall sampling time.

- **Set continuous processed data mode:** This sets the sampling rate to 1000 SPS and performs a continuous data capture processing 1000 samples at a time to yield one set of processed data samples every second.

The **Save** button saves the settings into the BMeasure unit.

The **Read** button reads the settings from the BMeasure unit.

See the BMeasure user manual for more information on measurements.

8. Measurement File Save Config

This configuration page controls the ability for the *bmeasure-gui* program to store the raw data acquisition sample stream and/or the processed data sample stream to files on disk.

- **File directory:** The location on the system into which data files will be saved.

- **Save raw data to file:** Enables saving of the raw sample data stream to a file.

- **Raw File Name:** The specification of the file name to be used. The base or full file name can be entered. If the **%{datetime}** tag is used in the file name it will substituted for the current date and time.

- **Raw File type:** Select the desired output file format. The following formats are currently supported:

  ◦ **bmeas:** Native BMeasure binary format containing all data and metadata.

- ◦ **csv:** Comma Separated Values (CSV) format with one line per sample containing data from all of the channels..
- ◦ **csv_with_header:** Same as CSV but with metadata in the first few lines of the CSV file.
- ◦ **tdms:** National Instruments data format.
- **Save processed data to file:** Enables saving of the processed sample data stream to a file.
- **Processed File Name:** The specification of the file name to be used. The base or full file name can be entered. If the **%{datetime}** tag is used in the file name it will substituted for the current date and time.
- **Processed File type:** Select the desired output file format. The following formats are currently supported:
  - ◦ **bmeas:** Native BMeasure binary format containing all data and metadata.
  - ◦ **csv:** Comma Separated Values (CSV) format with one line per sample containing data from all of the channels..
  - ◦ **csv_with_header:** Same as CSV but with metadata in the first few lines of the CSV file.

9. BMeasure-125i General Configuration

This configuration page sets up the general unit configuration

- **Autonomous Mode:** The mode of operation of the unit
  - ◦ **Idle:** Units starts in idle mode. Capture of data then need to be initiated by the bmeasure-gui program or API (eg Python code)
  - ◦ **Run:** Unit starts in running mode. In it will perform captures based on the Measurement Config setup on powerup.
  - ◦ **Program:** Units will start and run the specified autonomous program.
- **Autonomous Program:** Name for program saved on the unit to run at startup.#
- **Unit Name:** User entered name for the unit. This is passed as meta-data in saved files.
- **Unit Location:** User entered location for the unit.
- **Security Mode:** The security mode of the unit
  - ◦ **Basic:** Typically used when the unit is used locally via USB or local net Ethernet. Provides the easiest usage of the system. Upload of new firmware requires a user name and password.
- **Digital Mode:** This sets up the capability of the physical digital I/O hardware.
  - ◦ **Input:** All pins are inputs
  - ◦ **Output:**All digital pins are outputs
  - ◦ **InOut:** 4 inputs and 4 outputs.
  - ◦ **Sync Master**: Unit is a synchronous sampling master. Lower 4 digital i/o pins used to connect to up to 3 other units giving up to 32 synchronously sampled inputs.
  - ◦ **Sync Slave:** Unit is a synchronous sampling slave.
- **Calibrate DC:** Calibrate the capture ADC DC input offsets. All ADC analogue inputs need to be shorted.

- **Set Time:** Sets the time of the unit to the UTC time derived from host machine. In the case of a networked unit the time is normally updated via an NTP server.

- **Factory Reset:** Resets the unit to factory defaults.

10. AWG Config

This configuration page controls the setup of the the BMeasure-125i arbitrary waveform generator that is able to generate various waveforms and output these to the two analogue output channels.

- **Output:** This defines which analogue output channel or channels to output the waveform on.

- **Mode:** This defines the output mode.

  - **None:** disables the AWG.

  - **DC:** fixed voltage level.

  - **Sine, Square, Triangle, Noise:** Output wave form type

  - **TrackRms:** The output "tracks" the RMS processed value of a specified input channel. For example the RMS value of channel 5.

  - **TrackMean:** The output "tracks" the Mean processed value of a specified input channel. For example the Mean value of channel 5.

- **Frequency:** The frequency in Hz of the generated waveform. The output sample rate is 125 ksps. If tracking mode is configured this sets the frequency of the RMS or Mean averaging and tracking output values.

- **Amplitude:** The peak amplitude of the waveform in volts. In tracking mode this sets the scaling from tracked channel values to output voltage. For example if the input channel ranges from +-20 Volts and it is desired to get a tracking output of +- 5 Volts then an amplitude value of 0.25 would be used.

- **Offset:** The DC offset in volts applied to the output waveform or tracked value.

- **Duty:** The duty cycle of the waveform. This only applies to square waves and has a value from 0.0 to 1.0 with 0.5 being equal on and off periods.

11. BMeasure-125i Network Config

This configuration page sets up the unit network configuration.

- **Network Mode:** Ethernet mode of operation.

  - **Off:** The Ethernet interface disabled.

  - **DHCP:** The Ethernet interface is enabled and uses DCHP to request its set up parameters. In this mode it is not necessary to supply the additional parameters below.

  - **Manual:** The Ethernet interface is enabled and the setting are defined by the user.

- **Network Address:** IP address of the unit.

- **Network Mask:** Network mask for the unit.

- **Network Name server:** IP address of the Domain Name Server (DNS).

- **Network Time Server:** IP address of a network time (NTP) server.

- **Network Gateway:** IP address of the network gateway.

12. BMeasure-125i Wifi Config

This configuration page sets up the unit's Wifi network configuration.

- **Wifi Mode:** Wifi mode of operation.
  - **Off:** The Wifi interface is off and powered down.
  - **Client:** The Wifi interface is enabled in client mode and attempts to connect to a Wifi access point.
- **Wifi access points:** This lists the scanned Wifi access points available with their respective signal levels. Scans will only occur while the Wifi is disconnected from any access point. You can select the access point to connect to by clicking on it in the list. This will enter it's name into the Wifi Access Point Name setting box
- **Wifi Access Point Name:** The SSID name of the Wifi access point to connect to.
- **Wifi Access Point Password:** The password for the access point
- **Wifi Status:** The current Wifi Status.

When you click on the "Save and Set" button, the Wifi access point name and password is stored into the BMeasure-125i and will be used whenever the system is booted. The Connect and Disconnect buttons allow you to manually connect and disconnect from a Wifi access point.

13. BMeasure-125i Firmware

This configuration page enables review of the loaded firmware and the loading of firmware updates. Firmware updates can only be performed when connected through the USB interface. The unit should be powered at all times while uploading new firmware and the firmware operation should not be aborted until complete. Once the firmware has been uploaded successfully, use the Reboot button to reboot and install this firmware. When rebooting the bmeasure-gui application will disconnect from the BMeasure-125i unit. You can re-connect once the firmware update is complete in about 30 seconds.

- **Version:** Version numbers of the hardware and software.
- **Force update:** There are three separate firmware's used, the main CPU firmware, the FPGA's firmware and the Wifi firmware. Normally a firmware update will only update firmware that has a different version to that installed. This checkbox forces a firmware update even if the firmwares version is the same.
- **Firmware file:** Select the new firmware file to upload. Only install firmware if the unit is connected via USB.

14. BMeasure-125i Alarms

This configuration page allows alarms to be configured. There are 8 alarms that can be configured, one for each analogue input channel. Each alarm can be set to trigger on an input channel going above or below a programmed level. Once an alarm has been triggered it stays set until cleared.

When an alarm is triggered it will send an appropriate MQTT message if an MQTT server has been configured. An alarm can also drive one of the digital IO lines high or low or operate one of the two relays.

The alarm configuration page has one row per each of the 8 possible alarms,one for each analogue input channel. Each as the following settings:

- **Mode:** This specifies the mode of this alarm It can be set to

- ○ **Off:** Disables this alarm

- ○ **High:** Triggers when the measured value is greater than the "Level High" programmed value.

- ○ **Less:** Triggers when the measured value is less than the "Level Low" programmed value.

- ○ **Range:** Triggers when the measured value is outside the specified range specified in the "Level High" and "Level Low" range.

- ○ **Magnitude:** Triggers when the magnitude of the measured value (both positive and negative) is greater than the value specified in the "Level High" programmed value.

- **Level Low:** Low alarm point point value.

- **Level High:** High alarm point value

- **Output Mode:** This sets the output mode of the alarm.

  - ○ **None:** drives no outputs, but will send MQTT messages if MQTT is configured,

  - ○ **DIO High:** Sets the programmed digital output channel high on an alarm.

  - ○ **DIO Low:**- Sets the programmed digital output channel low on an alarm.

  - ○ **Relay On:** Enables the relay number as set in the "Output Channel" field

  - ○ **Relay Off** - Disables the relay number as set in the "Output Channel" field.

- **Output Channel:** The DIO output channel or relay number to set on the alarm being triggered.

The Alarm Configuration page has a **Save** button to save the configuration, a **Cancel** button to reset the changes made and a **Clear Alarms** button to clear any existing alarms.

An alarm condition can be cleared using the bmeasure-gui program, the BMeasure API, the HTTP/HTML WEB interface or the HTTP/JSON interface.

15. BMeasure-125i MQTT

This configuration page allows a MQTT (MQ Telemetry Transport) server to be configured to receive alarms and/or data. It has the following configurable parameters:

- **MQTT Mode:** This sets the MQTT mode.

  - ○ **Off:** - Disables MQTT,

  - ○ **On Alarm:** - Sends an MQTT message when an alarm is triggered or cleared.

  - ○ **On Data:** Sends a packet of data when available (typically once per second).

- **MQTT Server:** This is the host name or IP network address of the MQTT broker server.

- **MQTT Server Port:** This is the network port of the MQTT broker server to use. By default this is 1883.

The MQTT Configuration page has a **Save** button to save the configuration and a **Cancel** button to reset the changes made.

16. Channels Configuration

The Channel Config TAB provide the ability to setup the parameters relating to each acquisition channel. A single BMeasure-125i has 8 analogue and 8 digital channels. When units are slaved the additional available channels will be presented in the list.

- **Enable:** Enables enable the view of the selected channel in the graphs. For user developed programs the state of the enable can be read and used for user specific functionality.

- **Attenuator:** Check this option if the analogue channel selected has the input attenuator enabled. Each attenuator on the BMeasure-125i is enabled by physical jumpers located under the channel connector. Attenuation is fixed at 1/10.

- **PgaGain:** Each analogue input channel has a programmable gain amplifier. Fixed gains of 1,2,4 and 8 are available.

- **Type:** The type of the channel.

- **ID:** The ID of the channel. This ID is displayed on the graphs and used to identify data saved in the data log files.

- **Name:** A user entered value that can be used to identify the channel in the graphs and log files.

- **Units:** Units of the measurement

- **Scale:** A user specified value. Each sample is multiplied by the scale factor.

- **Offset:** A user specified offset applied to every data sample. Offset is applied to each sample prior to scaling.

- **Process:** Process applied to the channel data. Process is specific to certain sensor types. Currently there is one process type named "Power". When this is enabled on a channel a power calculation is performed by multiplying the channels data values with that of AI0 and then calculating its RMS value. AI0 is normally configured to measure a voltage and the processed channel measures the current.

17. Raw Data Graphs

The Raw Data TAB provides a means of viewing the raw sampled data captured by a BMeasure unit. Each channel enabled in the Channel Config TAB will be displayed in the graph. To the right of the graph is a panel giving control and information. The functions in this panel are determined by the pull down selector at the top of the panel.

- **Channel Selector:**   Selects the channel of interest. The selected channel's Units, RMS, Mean and Peek-Peek values are shown below. The special "Data Values" selection shows the RMS and Mean values for all the data channels.

- The **Single** button sets the graph to display only the specified channel while clicking the **All** button will display all the enabled channels.

- The **Set Colour** button provides the ability to change a channels graph colour.

- **X Offset:** Controls the start position on the x-axis.

- **X Scale:** Controls the scaling of the X-axis. The value can be entered or controlled using the keyboard arrow keys.

- **Load:** Loads a set of previously saved graph settings.

- **Reset:** Reset graph settings to factory defaults..

- **Save:** Saves the current scaling settings and trace colours

In single trace display mode, an FFT showing the spectrum of the channel data is shown below the trace. The amplitudes are given in dB relative to full scale.

18. Processed Data

The raw data samples can be processed by the BMeasure-125i unit to provide lower sample rate processed data. The system can support a number of data processing options. The BMeasure-125i will, for each channel, calculate the RMS, Mean, PeakHigh and PeakLow values of a set of raw data samples. If a specific channel has additional Process options set these will provide additional processed data. One such additional Process is the calculation of power for energy usage measurements.

In order to enable this Data Processing mode the **Measurement Config->Data Processing** checkbox has to be enabled and the number of samples to process has to be set in the **Data Process Duration** parameter. The maximum processed data rate is 10 Hz.

The Processed Data tab of the bmeasure-gui application presents the processed data samples in a table either as the Mean values for all channels or the full processed data for a specific channel. The Channel selector allows you to select these.

19. Data Logging

The Data log TAB enables the setup of internal data logging, the download of saved data and the deletion of saved data files. Data can be saved to either the onboard eMMC device or a plugged in SDCard. When logging is enabled a new log file is created on every capture run.

- **Enable Logging:** Enables logging
- **Logging Mode:** The mode of logging operation is one of two options
  - **Normal:** Data is saved to the specified logging device. When the device is full no more data will be saved.
  - **Delete Old:** Data is saved to the specified logging device. When the device is full the oldest data will be automatically deleted to make room for the new.
- **Logging Device:** Select the logging storage device. An SD Card option will be available when an SD Card is installed. This is also the device from which the saved files are listed and used when Format command button is pressed.
- **CSV Format:** This is the format of any downloaded CSV file. Normal is simply lines of data samples while with headers prepends meta data to the start of the file and provides headings for each data column in the data section of the CSV.
- **Refresh:** This button will list the files available on the selected storage device.
- **Download:** This button will download a selected data file. The target file type is selected from the file selection dialog that pops up.
- **Delete File:** This button will delete the selected file
- **Delete All Data:** This button will delete all the data on the specified storage device.
- **Format**: This button will format the specified device. A new SD Card should be formatted prior to use.