

Miro-F Class A Zone Substation Monitor and Logger

The **Miro-F TxM 304** is a Class A Power Quality monitor and logger designed specifically for Zone Substation monitoring. It offers comprehensive and reliable LV side transformer monitoring and includes measurements of three phase voltages, four currents (three phases and neutral), via potential and current transformers located in the switchyard, and two temperatures. The TxM 304 can be equipped with integrated remote cellular (3G/4G) communications or Ethernet and is therefore ideal for network wide asset management.



Figure 1: Miro-F TxM 304 - Zone Substation Monitor and Logger; Dimensions: (180 x 180 x 60) mm



Figure 2: Miro-F TxM 304 Ports

The TxM 304 incorporates terminal strips for voltage and current inputs to accept either 1A or 5A and incorporates four magnetic feet for quick and easy flush panel-mount installation.

Large scale network monitoring solutions utilising multiple Miro-F instruments can be implemented (as shown in figure 3); providing network engineers with information for planning, operations, maintenance and network modelling.

Scalable asset management systems

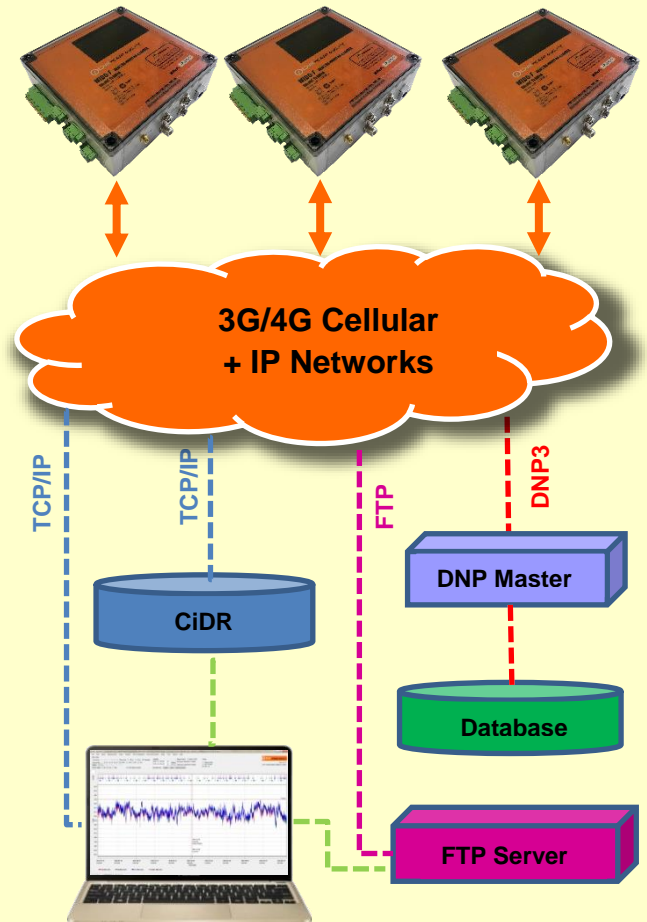


Figure 3: Miro-F - Scalable asset management systems. Remote connections to the Miro-F can be manual or automatic

Automatic DNP3: Data points polled periodically by a DNP master, stored in third party database, viewed by third party viewer for interrogation and analysis.

Automatic FTP uploads: Full PQ data including event captures pushed periodically to FTP server, to be viewed by proprietary Citrus software or converted to PQDIF format for use with third party analysis tools.

CiDR (Citrus Data Retrieval): CiDR is a service for automatically collecting data from the Miro loggers. It allows users to schedule downloads of Miro files;

Upgrade firmware; Synchronise the time; and Automatically convert Miro data files into PQDIF format.

Manual TCP/IP: Connect using CITRUS TCP/IP via a 3G/4G or Ethernet communications module which provides a transparent connection and allows configuration, download of logged data and firmware updates.

The above systems can be deployed anywhere within cellular coverage and can support multiple Miro-F instruments. Secure communication can be established using SSH (Secure Shell) for TCP/IP and FTPES (File Transfer Protocol Explicit Security) for FTP.

Key hardware features

- Certified to IEC61000-4-30, Class A
- AC and DC (voltage only) and AC current measurements.
- Surface and ambient temperature probes.
- The Miro-F TxM 304 can be incorporated with relay outputs to initiate appropriate action (under development).
- Powered from Phase A to Neutral or via DC power adaptor.
- Starts logging on power up.
- Concurrent logging at multiple log intervals: 10/12 cycles, 150/180 cycles, 10s, 10m, 2h, and user configurable.
- Gapless logging: User can download data, clear log memory and configure the device with no interruption to logging.
- Internal backup battery: 5-minute back up time as standard, with option to extend upon request.
- GPS and external antenna for precision time synchronisation.
- Choice of remote communications via Cellular (3G/4G) or Ethernet. All peripherals are integrated within the enclosure other than an external antenna.
- Integrated WiFi options for Android and iOS mobile applications.
- Logged memory: 8GB
- Graphical colour display
 - Voltage and current waveforms
 - Phasor diagrams.
 - Measurements.
 - Status information.
 - User defined screen.

Key software (CITRUS) features

- The CITRUS platform is a powerful, easy to use and intuitive analysis software that supports all CHKPQ products. It provides tools for: device management; data analysis; and reporting.
- Configurations
 - Pre-defined configurations for easy setup.
 - Create and store different configuration files for quick retrieval.
- Online monitor, with event trigger option (ideal for motor starts).
- View multiple log file data on the same graph to compare PQ measurements with GPS synced time stamps.
- Event type filter to view only desired events.
- Analysis and Compliance reporting
 - Voltage and Harmonic compliance profiles
 - 24-hour scatter plot.
 - Voltage and Harmonic compliance graphs.
- Multi-parameter capture
 - Allows users to record a 2-minute (30-second pre-trigger and 90-second post-trigger) capture of RMS Voltage and Current; Power (Real, Reactive & Apparent); Power Factor & Frequency at cycle-by-cycle intervals when events are captured.

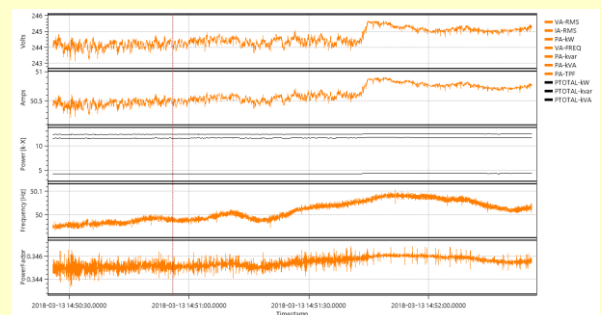


Figure 4: Multi-parameter capture

- Real-time Alarms and Notifications
 - Alarms can be generated upon user set thresholds e.g. over/under voltage; underfrequency and THD being exceeded.
 - Real-time notifications can be sent via SMS, Email, or direct IP to a designated server.
- Views
 - Ability to edit an active view: Text and arrow annotation and title options available.
 - Generate a PDF, CSV file, or table.
 - Split or combine voltage and current graphs.
 - Multiple measurements on a single graph.
 - Horizontal and vertical cursors for accurate measurements.
- PQDIF export - PQView compatible.
- Automatic FTP uploads

Benefits

Local product

- Designed and manufactured in Australia
- Support - direct from the manufacturer
- Regular software and firmware updates
 - New features can be added on request

Operate directly from mains voltage

- Built in Phase A power supply to cover full 600V operating range
 - No external supplies or batteries required for any current sensor/GPS/modem

External supply and backup

- Can be powered from external 12V DC.
- Backup battery to cover interruptions up to 5 minutes
 - Option for larger battery

Current sensors

- 1A or 5A CT's built within the instrument's enclosure.

Voltage isolation

- Safety:
 - >10kV voltage isolation

Installation

- Small and light easy to install. Secure connections for voltage and current inputs

Fully class A compliant

- Full Class A compliance both for online mode and for logged data
 - High accuracy
 - Repeatable, comparable measurements
 - 10/12 cycle base interval can be logged for all parameters

Logging

- Concurrent logging at all Class A intervals plus a user-adjustable interval
 - No need to "re aggregate" in software
 - Can do 10-minute logging for voltage and harmonic compliance plus faster logging for diagnostic purposes, at the same time

Mains signalling

- Multiple mains signalling options
 - Maximum level only
 - Daily maximum table available
 - 10/12 cycle (200ms) capture up to five minutes
 - Voltage and current
 - Can also capture total RMS
 - Fast 20ms capture

Memory

- 8GB memory
 - Log for up to two years with default configuration
- No lossy compression or other "shortcuts" to extend memory capacity at the cost of accuracy and/or standards compliance

Gapless logging

- Full gapless logging
 - Can download, reconfigure and clear at any time without stopping the logging
 - No interruption or gaps introduced
 - Suitable for fixed or long-term monitoring
 - Maximises user convenience even if gapless logging is not required

Fast and easy

- Fast downloads - 60 to 120 MB per minute
- Fast configuration, easy to reset back to defaults
 - All configuration is in a single form
- Fast clearing – less than a second
- Easy firmware updates
 - No special tool or procedure required
 - No need to clear memory or configuration
 - Unit will restart when firmware upload completes and resume logging immediately

GPS and remote communications

- Built in GPS
 - Time sync required for Class A
- Fully integrated remote communications
 - Direct connection – equivalent to USB connection
 - Automatic uploads by FTP

No buttons or switches

- Automatically starts logging on power up unless configured otherwise.
- No risk of forgetting to set up logging

Display

- LCD:
 - Clearly display logging status
 - Quickly verify correct installation
 - Waveform displays available
 - Display can be turned off with no effect on logging
 - High update rate – every 10 or 12 cycles

Analysis Software

- Software:
 - Free Citrus software
 - Small download, easy and fast to install
 - Built for both 32- and 64-bit Windows
 - Supports all Windows versions from XP through to 10

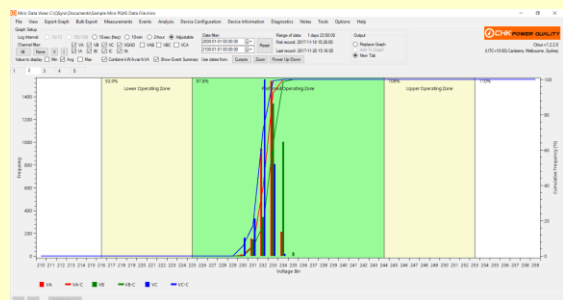


Figure 2 - Voltage histogram with cumulative frequency

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- Main executable is portable – can view data files without installation and without administrator privileges
- Digitally signed to verify it was sourced from CHK Power Quality
- Easy to use
- Familiar “look and feel” for existing PowerView users
- Tabbed view to quickly compare different graphs
- Easily add additional parameters to graphs
- Cursors, text and arrow annotations available
 - Tied to data, not to position on screen
 - Correct position maintained when panning and zooming
- Zooming
 - Click and drag or by scroll wheel
 - Zoom multiple axes or a single axis at a time
- Quickly reset zoom on double click
- Convert graph to table or CSV file
- Date/time range and channel selection available for all parameters and analysis charts
- Analysis features built in:
 - Voltage compliance
 - Harmonic average over the log
 - Harmonic compliance
 - Voltage and current
 - Daily minimums and maximums
 - Total energy
 - Hourly energy profile
 - Split imports/exports – useful for solar installations
- PQDIF export – “PQView” compatible (under development)

Hardware specifications

PARAMETER	DESCRIPTION
Power quality parameters	
Class A declared/nominal input	230V 50Hz/60Hz
Power frequency	IEC61000-4-30 (section 5.1).
Magnitude of the supply voltage	IEC61000-4-30 (section 5.2).
Flicker	IEC61000-4-30 (section 5.3).
Supply voltage dips and swells	IEC61000-4-30 (section 5.4).
Voltage interruptions	IEC61000-4-30 (section 5.5).
Supply voltage unbalance	IEC61000-4-30 (section 5.7).
Voltage harmonics	IEC61000-4-30 (section 5.8).
Voltage interharmonics	IEC61000-4-30 (section 5.9).
Mains signalling voltage on the supply voltage	IEC61000-4-30 (section 5.10).
Rapid voltage changes (RVC)	IEC61000-4-30 (section 5.11).
Underdeviation and Overdeviation	IEC61000-4-30 (section 5.12).
Measurement	
A to D Conversion	16 bits.
Samples per cycle	384 @ 50 Hz; 320 @ 60 Hz.
Sampling Rate	Nominal: 19.2kHz synchronised to mains.
Anti-aliasing	High-frequency components attenuated by at least 50dB so as not to interfere with harmonic measurements.
Measurement metrics	
Frequency	Range: 50Hz nominal (42.5-57.5)Hz, 60Hz nominal (51.0-69.0)Hz; Full range: (40-70)Hz. Measurement: 10s; Accuracy: ± 5 mHz referenced to RTC, ± 1 mHz referenced to GPS.
Magnitude of the supply voltage (true RMS)	Measurement: 10/12 cycle rms Range: 10% to 150% of nominal value with accuracy of $\pm 0.1\%$ of nominal value under conditions specified in IEC61000-4-30 section 6.1.
Flicker	IEC61000-4-15, 10-minute Pst (short term) and 2hr Plt (long term).
Dips and swells	Measurement: 1-cycle rms updated every half cycle. Accuracy: $\pm 0.2\%$ of nominal value, ± 1 cycle. Range (magnitude) 0 to 200%.

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	Range (duration) minimum 0.5 cycles by definition. No upper limit.
Voltage interruptions	Measurement: 1-cycle rms updated every half cycle. Accuracy: ± 1 cycle. Range (duration) minimum 0.5 cycles by definition. No upper limit.
Voltage and current unbalance	Applicable 3 phase systems and evaluated using the method of symmetrical components. Metrics: $u_2 = (U_2/U_1)$ and $U_0 = (U_0/U_1)$. U_0 , U_1 and U_2 are sequence components. Range: 0.5% to 5% of U_2 and U_0 . Accuracy: $\pm 0.15\%$.
Power meter	Power-kW, Power-kVA, Power-kVAR, True Power Factor (TPF), Displacement Power Factor (DPF).
Voltage harmonics / interharmonics	IEC61000-4-7, Class I (up to 50 th harmonic). Range: 10% to 200% of Class 3 electromagnetic environment in IEC 61000-2-4. Metrics: voltage and current magnitude and angle. 51 st to 100 th : Indication only.
Total harmonic distortion (THD)	IEC61000-4-7, THDS (up to 50 th harmonic)
Mains signalling (Ripple amplitude)	Signal: <3kHz, user specified frequency. 20Hz bandwidth (4-nearest-bins method, adjusted automatically to correct for fundamental drift). Measurement: 10/12 cycle rms amplitude maximum value. Measurement range: 0%-15% of the nominal value. Detection threshold: >0.3% of nominal voltage, Duration: user defined from 1s to 300s. Trigger input to Ripple capture.
RVC	RVC threshold: user defined between 1% and 6% of the nominal value. RVC hysteresis: user defined and < RVC threshold.
Underdeviation / Overdeviation	Separately measure voltages above and below the nominal value. Metrics: RMS-under, RMS-over, %U _{Under} and %U _{Over} .
Crest factor	Indicates peak-to-rms ratio of waveform. $\pm 1\%$.
Temperature	Two temperature channels measured each second, recording at adjustable, 10-min and 2-hour intervals. Measurement: -50°C to +150°C. Accuracy: $\pm 1^\circ\text{C}$.
High speed event recording	
Triggers	User defined. Sliding reference, Dip/Swell, transient (dv/dt), manual (via Online Monitor), Frequency rate of change (Hz/s) (Optional).
Event Waveform capture	User defined. Pre-trigger: 100ms; Post trigger: 400ms; Option for extended capture (eg. motor start). Duration: 2s or 10s.
Event RMS capture (half cycle RMS)	2.5s pre-trigger, 25s post-trigger (50Hz)
Event Multi-parameter capture	Up-to 2-minute capture (30s pre-trigger and 90s post-trigger) at a cycle-by-cycle interval for RMS Voltage & Current; Power (Real, Reactive, Apparent), (per phase plus total power); Power Factor (per phase); Frequency.
Ripple capture (10/12 cycle RMS)	Duration: 1s to 300s. Triggered by exceedance of detection threshold (see above).
Communications	
Wired data (standard)	USB 2.0. Ethernet (Optional)
Wireless (options)	Cellular remote communications and WiFi integrated within the instrument.
Logging	
Logged data memory	8GB.
Logging intervals	All IEC61000-4-30 intervals simultaneously plus adjustable interval from 1s to 3600s.
Measurements	All measurements simultaneously.
GPS location	GPS location coordinates logged periodically.
General	
Circuit connections	Three phase delta, three phase Wye & single phase.
Data file	PQA format binary with CSV export.

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Data display	Real time measurements of basic parameters via LCD, all parameters via Online Monitor.
Software tools	CITRUS.
Inputs	
Voltage channels (AC/DC)	Common Neutral.
Voltage range (working maximum per isolated input pair)	Powered from phase A: 600VACrms (850Vpk) Internal supply disabled: 700VACrms (1000Vpk)
Voltage surge protection (differential)	4kV Fast transients, 6kV 1.2/50us impulse – no effect. Recalibration may be required after impulses significantly exceeding 6kV.
Current channels (AC)	4.
Current range	1A or 5A Factory set.
Temperature channels	2 x PT100 RTD, M8 connectors.
Instrument type	IEC61000-4-30, Class A.
Accuracy	
Reference conditions	22°C.
Current (instrument)	±0.2% of full scale. System accuracy depends on sensor.
Voltage	±0.1% of nominal value as specified above.
Voltage temperature coefficient	Approx. 25ppm/C
Environment and safety	
Use	Indoor.
Altitude	Up to 2000m.
Operating Temperature	-20°C to +60°C.
Certifications / type testing	
EMC	EN55022:1998 _A1:2000 +A2:2003 CLASS A.
Random Vibration	MIL STD 810 G.
Power	
Power supply	Phase A voltage, range: (60-600)VACrms; 15VA typical.
USB powered (Mini USB)	Configuration and download.
External DC supply	Plug pack provided.
Backup power	Rechargeable battery - LiFePO ₄ .
Backup battery duration	5 minutes. Longer duration (30 minutes with 24 hours recharge) available on request.
Timing	
Real time clock (RTC) battery	Non-rechargeable Lithium backup battery. Functional life: > 10 years.
RTC	Typical ±3ppm from -15 to 60C. Drift <1 second per week.
GPS (internal)	Time accuracy: <1ms. External antenna required.
Mechanical	
Display	Colour graphic LCD (4.3" 480x272 Graphic TFT LCD); Dimensions: (97 x 56) mm.
Enclosure dimensions	(180 x 130 x 60) mm; Length side ports: Current and voltage channels; Width side ports: Data, and Temperature.
Weight	1.05kg (instrument only).
Case material and colour	Polycarbonate, moulded in light grey.

Software specifications

FEATURE	DESCRIPTION
General	
Software platform	CITRUS – software platform used to manage all company products.
Application launch	Automatically when clicking on a CITRUS file.
Miro data View	
File	
Features	Open; Open Recent; Add File; Remove File; Exit.
View	
Features	Save view to log file; Load saved view; Set Zoom; Cursors; Add Title ; Add Notes as Footer; Add Text Annotation; Add Arrow Annotation; Toggle Split/Combine; Toggle Date/Time mode ; Close Tab.
Export	
Features	Prints current graph; Generates PDF of the current graph; Generates PNG of the current graph; Generates SVG of the current graph; Generates clipboard of the current graph; Generates CSV of the current graph. Custom CSV upon request; Generates Table of the current graph.
Measurements	
RMS and Frequency	Graphical view of logged: TRMS; AC; DC, Crest Factor; Fundamental Magnitude; Fundamental Phase; Frequency; Underdeviation; and Overdeviation.
Power and Unbalance	Graphical view of logged: Real Power; Reactive Power; Apparent Power; True Power Factor; Displacement Power Factor; Real Power Total; Reactive Power Total; Apparent Power Total; Unbalance (Negative Sequence); and Unbalance (Zero Sequence).
Harmonics	Graphical view of logged: Harmonic Magnitude; Harmonic Percentage of Fundamental; Harmonic Phase; Interharmonic Magnitude; and THD.
Flicker	Graphical view of logged short term (Pst) and long term (Plt) flicker.
Temperature	Graphical view of logged temperature channels.
Events	
View of events	Dips/Swells/Interruptions; RMS Capture; RVC; Waveform Capture; Multi-Parameter Capture; Mains Signalling Maximum; and Mains Signalling Capture. Listed events change accordingly.
Voltage slider reference filter	Ignores trigger levels less than the set level.
Graphical tools	Split Volts/Amps; Vas a % of Nominal; Graph channel filter (VA, VB, VC, VGND, 1A, IB, IC, IN); Load V and I channels; Reload; Clipboard; Print; Add Title; Export PDF; Add Cursors; Export Table.
Analysis	
Harmonic average	Percentage of Fundamental and Magnitude.
Harmonic compliance	Voltage: Percentage of Fundamental; Proportion of Compliance Limits; Set Compliance Limits. Current: Percentage of Maximum Demand; Proportion of Compliance Limits; Set Compliance Limits.
Voltage compliance	Setup; Percentile Table; Histogram.
Daily Min/Max	TRMS, Frequency, THD, TPF, kW, kVAR, kVA, Mains Signalling maximum.
Energy calculator	kWh, kVarh, kVAh, kWh hourly profile, kWh hourly import/export (useful for solar installations) and power.

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ITI (CBEMA) curve	Displays severity and duration of dips and swells.
Custom	Upon request.
Device Configuration	
Configuration tabs	Inputs, Measurement Intervals, RMS and Power, Harmonics and Flicker, Mains Signalling, IEC Events, Alarms, Capture Triggers, Capture Types, LCD, Comms.
Configuration file	Can append a description.
General configuration features	Load From file; Save To file; Save Config To Device; Reset To Default; Enable All Log Points; Disable All Log Points.
Set log date-time range	Log start, Log stop, Reset.
Data usage estimate	Estimated data per day; Estimated data per month; Days to 100 MB; Days to 1 GB.
Device information	Model, serial number, calibration date, CT types and firmware version.
Notes	Log notes - add text to be viewed as footer.
Tools	
Features	Join Open Files; Split File; Set Voltage Scaling; Set Current Scaling; Custom ratio; CK1/CK5 with 1A/5A CT.
Options	
Features	Display Time Zone; Colour Settings.
Help	
General graphical tools	
Online Monitor	
Features	Ability to view all parameters plus waveforms in real-time. Tabs: RMS and Power; Phasor Diagram; RMS Plot; Harmonic Magnitude (table); Harmonic Magnitude (bar chart); Harmonic Phase; Harmonic Power (bar chart) [Displays direction for selected harmonics, and referenced to the direction of the Power frequency]; Interharmonics; Flicker; Events; Waveforms.
Aggregation interval	10/12 cycle; 150/180 cycle; 10-min; 2-hour; Adjustable.
Sampling rate	Displayed.
Operations Window	
Operations	Online Monitor; Configuration; Download; Clear memory after download; Clear Download Portion; Clear All Memory; Set Time; Update Firmware.
Status information	Mode1; Serial Number; Calibration state; Firmware; Boot Counter; Channel; CT Types; Operating mode; Comms status.
Management Window	
Open data File	Opens Miro data file with ability to browse.
Connect USB	Connects to the Miro using direct cable connection.
Connect TCP/IP	Enter IP address
Offline configuration (tabs)	Inputs, Log Intervals, RMS and Power, Harmonics and Flicker, Mains Signalling, IEC Events, Capture Triggers, Capture Types, LCD, Comms.
Tools (Join Multiple Files)	Data files must have same serial number (data generated from the same instrument).
Open Recent	Select a Miro file from a list of recently opened files.