BTS-16110 gRPC API Reference

proto/MeasurementStream.proto Service Table

MStream

The MStream service provides functionality for streaming

voltage and current data over UDP/TCP connection.

Method Name	Request Type	Response Type	Description
StartMeasurementsStream	StartMeasurementsStreamRequest	MeasurementsStreamReply	Starts the UDP/TCP stream. Data is immediately and continuously sent in 1ms packets to the destination IP. Data is reported in base SI units.
EndMeasurementsStream	EndMeasurementsStreamRequest	MeasurementsStreamReply	Ends the associated UDP/TCP stream.

proto/NIBMU.proto Service Table

NIBMU

NIBMU Service provides gRPC requests and replies for all basic function of the BTS-16110

This service does not include measurement streaming functionality.

Method Name	Request Type	Response Type	Description
Reserve	ReserveRequest	ReserveResponse	Reserve the BTS-16110 for use during a measurement session.
Unreserve	UnreserveRequest	UnreserveResponse	Unreserve the BTS-16110 so that it is available for use.
ClearReservation	ClearReservationRequest	ClearReservationResponse	Clears the reservation on the server to a default state with no open sessions. Must confirm with ClearReservationConfirmation.
ClearReservationConfirmation	ClearReservationConfirmationRequest	ClearReservationConfirmationResponse	Confirms that the current reservation should be cleared. Must be called after ClearReservation.
GetDeviceProperties	GetDevicePropertiesRequest	GetDevicePropertiesReply	Returns device properties such as serial number, P/N, and revision number.
GetRevision	GetRevisionRequest	GetRevisionResponse	Provides current revision information for the LabVIEW Real-Time application installed on the BTS-16110.
			Returns device status information,

GetStatus	GetStatusRequest	GetStatusReply	including but not limited to warmup state, faults encountered, and background calibration state. Refer to GetStatusReply for details.
GetTimeSensitiveNetworkStatus	GetTimeSensitiveNetworkStatusRequest	GetTimeSensitiveNetworkStatusReply	Returns the status of Time Sensitive Network (TSN) Synchronization for the Ethernet ports.
GetTemps	GetTempsRequest	GetTempsReply	Returns the device temperature in the volts and current hot pockets. Voltage and current temperatures should read 65°C, nominal.
GetCalDate	GetCalDateRequest	GetCalDateReply	Returns either the date when the device was last calibrated or the date when the device must be recalibrated.
SetTransducerConfig	SetTransducerConfigRequest	SetTransducerConfigReply	Sets the measurement configuration of the current transducer input. Set the fields to match the specifications of your current transducer.
GetTransducerConfig	GetTransducerConfigRequest	GetTransducerConfigReply	Returns the configuration of the current transducer input.
SetBackgroundCalMode	SetBackgroundCalModeRequest	SetBackgroundCalModeReply	Sets the background calibration mode so that it is either on or off.
ChangeCalPassword	ChangeCalPasswordRequest	ChangeCalPasswordReply	Changes the password to allow external calibration.
StartCalibration	StartCalibrationRequest	StartCalibrationReply	Starts the external calibration process.
PerformCalibrationStep	PerformCalibrationStepRequest	PerformCalibrationStepReply	Performs the requested external calibration step. Refer to CalStep and PerformCalibrationStepRequest for details.
SetCalTemp	SetCalTempRequest	SetCalTempReply	Sets the temperature recorded during calibration.
SetCalDate	SetCalDateRequest	SetCalDateReply	Sets the date when the device was last calibrated or the date when the device must be recalibrated.
CompleteCalibration	CompleteCalibrationRequest	CompleteCalibrationReply	Completes calibration. Writes Calibration coefficients to memory if the data is not discarded.

Detailed Message Information

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proto/MeasurementStream.proto Messages

MeasurementStreamSelect

Definitions for the different measurement streams.

Name	Number	Description
MEAS_STREAM_SEL_1000_SAMPLES_PER_SECOND	0	1kS/s stream over UDP.
MEAS_STREAM_SEL_1250000_SAMPLES_PER_SECOND	1	1.25MS/s stream over TCP.

EndMeasurementsStreamRequest

Request to stop the associated measurement stream.

Field	Type	Description
vi	Session	Session information with reservation token.
measurement_stream_select	MeasurementStreamSelect	Specifies the associated measurement stream to stop.

MeasurementsStreamReply

General Reply for MStream Service.

Field	Type	Description
reply_information	ReplyInformation	See ReplyInformation

ReplyInformation

General reply information for the MStream service.

Field	Type	Description
status	int32	Returns the error status. 0 indicates no error. Refer to syslog for error details.
message	string	A description of the error.

Session

Definition for a session which requires the reservation token.

Field	Type	Description
reservation_token	string	Unique value generated by the BTS-16110 for each measurement session.

StartMeasurementsStreamRequest

Request to start the measurement stream and stream data.

Field	Type	Description
vi	Session	Session information with reservation token.
dest_ip	string	The IP address to stream data to; usually the host PC.
dest_port	int32	Destination port for UDP/TCP streaming.
measurement_stream_select	MeasurementStreamSelect	Specifies the associated measurement stream to start.

proto/NIBMU.proto Messages

BackgroundCalibrationMode

Definitions for background calibration modes.

Name	Number	Description
BG_CAL_MODE_CONTINUOUS	0	Setting for background calibration to be on.
BG_CAL_MODE_PAUSED	1	Setting for background calibration to be off.

CalDateSelect

Definitions for selecting a calibration date.

Name	Number	Description
CAL_DATE_SEL_LAST	0	The date that the device was last calibrated.
CAL_DATE_SEL_DUE	1	The date that the device must be re-calibrated to maintain warranted specifications.

CalStep

Definitions for the types of steps performed during external calibration.

Name	Number	Description
CAL_STEP_NONE	0	The default calibration state; not used.
CAL_STEP_CHECK_BANANA_CONNECTED	1	Returns an error if the volts device measurement does not match the given expected measurement. Used to ensure that the input is cabled to the volts input.
CAL_STEP_BANANA_VOLTS_1500	2	Performs the calibration for the volts input. Requires a 700 V input.
CAL_STEP_CHECK_DSUB_CONNECTED	3	Returns an error if the current device measurement does not match the given expected measurement. Used to ensure that the input is cabled to the current input.
CAL_STEP_DSUB_VOLTS_10	4	Performs the calibration for the current input. Requires a 7 V input.
CAL_STEP_DSUB_SHUNT_AMPS_2	5	Performs the calibration for the current input shunt. Requires a 1.4 A input.

ExternalCalibrationMode

Definitions for which external calibration mode the device is in.

Name	Number	Description
EXT_CAL_MODE_STANDARD	0	Standard calibration mode where the device is not being externally calibrated. This is the default state for the device.
EXT_CAL_MODE_CALIBRATION	1	Calibration mode where the device is currently being externally calibrated.

GainSelect

Definitions for the gains supported on the current transducer input.

Name	Number	Description
GAIN_SEL_VOLTS_10	0	10 V gain mode; used with voltage mode transducers.
GAIN_SEL_AMPS_2	1	2 A gain mode; used with current mode transducers >667mA max signal current.
GAIN_SEL_MILLIAMPS_667	2	667 mA gain mode; used with current mode transducers <667mA signal current.

ChangeCalPasswordReply

Response to the request for changing the password to allow external calibration.

Field	Type	Description
reply_information	ReplyInformation	General reply information.

ChangeCalPasswordRequest

Request to change the password to allow external calibration. Must be preceded by StartCalibration and followed by CompleteCalibration.

Field	Type	Description
vi	Session	Session information which contains the reservation token needed to access a reserved device.
current_cal_password	string	Current external calibration password to change. Default password is 'NI.'
new_cal_password	string	New password to allow external calibration.

ClearReservationConfirmationRequest

Request to confirm clearing of the device reservation.

Field	Type	Description
clear_reservation_token	string	New reservation token from ClearReservation.

ClearReservationConfirmationResponse

Response to the request for confirmation that the device reservation cleared.

Field	Type	Description
reply_information	ReplyInformation	General reply information.
is_reservation_clear	bool	Reservation clear status. Returns True if the device was previously reserved and the reservation was cleared, otherwise False.

ClearReservationRequest

Request to clear the device reservation. No parameters required.

ClearReservationResponse

Response to the request to clear the device reservation.

Field	Type	Description
reply_information	ReplyInformation	General reply information.
clear_reservation_token	string	New reservation token for clearing the device registration. Used with ClearReservationConfirmation.

CompleteCalibrationReply

Reply to the request to complete external calibration.

Field	Type	Description
reply_information	ReplyInformation	General reply information.

CompleteCalibrationRequest

Request to complete external calibration.

Field	Type	Description
vi	Session	Session information with reservation token.

| discard | bool | Set True to discard calibration data or False to retain calibration data. |

GetCalDateReply

Response to the request for date(s) for external calibration.

Field	Type	Description
reply_information	ReplyInformation	General reply information.
cal_date	uint64	Timestamp of the requested external calibration date.

GetCalDateRequest

Request to get the date(s) for external calibration.

Field	Type	Description
vi	Session	Session information which contains the reservation token needed to access a reserved device.
cal_date_select	CalDateSelect	Selection for the date of the last external calibration or the due date for the next external calibration.

GetDevicePropertiesReply

Response to the request for device properties.

Field	Type	Description
reply_information	ReplyInformation	General reply information.
part_number	string	The part number of the device.
serial_number	uint32	The serial number of the device in decimal representation.
revision	string	The revision of the device.

GetDevicePropertiesRequest

Request to get the device properties.

Field	Type	Description
vi	Session	Session information which contains the reservation token needed to access a reserved device.

GetRevisionRequest

Request for GetRevision. No parameters required.

GetRevisionResponse

Response of GetRevision.

Field	Type	Description
signature	uint32	Sanity check, always "C3346A" unless program is corrupted.
revision	uint32	Revision number.
oldest_compatible_revision	uint32	Oldest compatible version for server integration.
rt_app_version	string	Version for the associated LabVIEW Real-Time application of the project. Uses the format "RT proj version 24.5.0fxxx."
image_version	string	Version for the associated LabVIEW Real-Time application set by manufacturing. This will not change if the device application is updated.

GetStatusReply

Reply to the request for BTS-16110 status. Provides fields that return device health and status.

Field	Type	Description
reply_information	ReplyInformation	General reply information.
ip_address	string	Host name of the device.
mode	ExternalCalibrationMode	Queries the external calibration mode (standard or calibration).
is_reserved	bool	Returns True when the device is currently reserved, or False when the device is not currently reserved.
warmup_complete	bool	Returns 0 if the device is warming up, or 1 if the device is warmed up.
fault_bitield	uint64	Field where each bit is associated with a specific fault. Each bit asserts 1 if a fault is detected. Bit 0: Transducer Status Bit 1: Power Supply Good Bit 2: Voltage Heater High Bit 3: Voltage Heater Low Bit 4: Current Heater High Bit 5: Current Heater Low Bit 6: Time Synchronization Fault
vi	Session	Session information which contains the reservation token needed to access a reserved device.

GetStatusRequest

Request for the device status. No parameters required.

GetTempsReply

Reply to the request for critical device temperatures.

Field	Type	Description
reply_information	ReplyInformation	General reply information.
volts_temp	float	Temperature of the voltage pocket. Should be at 65 °C for maximum accuracy. Maximum range is 60 °C to 70 °C.
amps_temp	float	Temperature of the amps pocket. Should be at 65 °C for maximum accuracy. Maximum range is 60 °C to 70 °C.

GetTempsRequest

Request to get the critical temperatures of the device.

Field	Type	Description
vi	Session	Session information which contains the reservation token needed to access a reserved device.

GetTimeSensitiveNetworkStatusReply

Response to the request for TSN synchronization status.

Field	Type	Description
reply_information	ReplyInformation	General reply information.
eth0	TimeSensitiveNetworkStatus	TSN synchronization status for Ethernet port 0.
eth1	TimeSensitiveNetworkStatus	TSN synchronization status for Ethernet port 1.

GetTimeSensitiveNetworkStatusRequest

Request to get the status of TSN synchronization.

Field	Type	Description
vi	Session	Session information which contains the reservation token needed to access a reserved device.

GetTransducerConfigReply

Response to the request for the current transducer input configuration.

Field	Type	Description
reply_information	ReplyInformation	General reply information.
gain_select	GainSelect	Gain selection for the input; valid values are 10 V, 2 A, or 667 mA.
turns_ratio_primary	int32	Primary value in the transducer turns ratio.
turns_ratio_secondary	int32	Secondary value in the transducer turns ratio.

GetTransducerConfigRequest

Request to get the device configuration for the current transducer input.

Field	Type	Description
vi	Session	Session information which contains the reservation token needed to access a reserved device.

PerformCalibrationStepReply

Reply to the request for performing a step in the external calibration process.

Field	Type	Description
reply_information	ReplyInformation	General reply information.

PerformCalibrationStepRequest

Request to perform a step in the external calibration process.

Field	Type	Description
vi	Session	Session information which contains the reservation token needed to access a reserved device.
cal_step	CalStep	The external calibration step requested to perform.
expected_cal_measurement	float	The expected input/measurement for the associated calibration step.

ReplyInformation

General reply information for the NIBMU service.

Field	Type	Description
status	int32	Error status. Returns 0 for no error. Refer to syslog for detailed error reporting.
message	string	A description of the error.

ReserveRequest

Request for reserving the BTS-16110. No parameters required.

ReserveResponse

Response from reserving the BTS-16110. Includes session information for messages which require it.

Field	Type	Description
reply_information	ReplyInformation	General reply information.
vi	Session	Session information which contains the reservation token needed to access a reserved device.

Session

Definition for a session which requires the reservation token.

Field	Type	Description
reservation_token	string	Unique value generated by the BTS-16110 for each measurement session.

SetBackgroundCalModeReply

Response to the request to set the background calibration mode.

Field	Type	Description
reply_information	ReplyInformation	General reply information.

SetBackgroundCalModeRequest

Request to set the mode for background calibration.

Field	Type	Description
vi	Session	Session information which contains the reservation token needed to access a reserved device.
background_cal_mode	BackgroundCalibrationMode	The background calibration mode to set.

SetCalDateReply

Response to the request to set the date(s) for external calibration.

Field	Type	Description
reply_information	ReplyInformation	General reply information.

SetCalDateRequest

Request to set the date(s) for external calibration.

Field	Type	Description
vi	Session	Session information which contains the reservation token needed to access a reserved device.
cal_date_select	CalDateSelect	Selection for the last calibration date or the next calibration date.
cal_date	uint64	Timestamp of the requested external calibration date.

SetCalTempReply

Response to the request to set the temperature of external calibration.

Field	Type	Description
reply_information	ReplyInformation	General reply information.

SetCalTempRequest

Request to set the temperature of external calibration.

Field	Type	Description
vi	Session	Session information which contains the reservation token needed to access a reserved device.
cal_temp	float	The temperature of external calibration.

SetTransducerConfigReply

Response to the request to configure current transducer input

Field	Type	Description
reply_information	ReplyInformation	General reply information.

SetTransducerConfigRequest

Request to set the device configuration for the current transducer input.

Field	Type	Description
vi	Session	Session information which contains the reservation token needed to access a reserved device.
gain_select	GainSelect	Gain selection for the input, can be 10V, 2A, or 667mA.
turns_ratio_primary	int32	Primary value in the transducer turns ratio.
turns_ratio_secondary	int32	Secondary value in the transducer turns ratio.

StartCalibrationReply

Response to the request to start external calibration.

Field	Type	Description
reply_information	ReplyInformation	General reply information.

StartCalibrationRequest

Request to start external calibration.

Field	Type	Description
vi	Session	Session information with reservation token.
calibration_password	string	Password allowing external calibration to start. Default password is 'NI.'

TimeSensitiveNetworkStatus

TSN synchronization status information.

Field	Type	Description
enabled	bool	Returns True if TSN synchronization is enabled and operational.
grandmaster_changed	bool	Returns True if the TSN grandmaster has changed during the current reservation session. Device must be unreserved to reset to False.
grandmaster_clock_id	string	MAC address of the grandmaster device on the TSN. When the 'enabled' field is False this is the MAC address of BTS-16110 itself.
offset_in_ns	double	Offset in nanoseconds from the grandmaster device off the TSN. When the 'enabled' field is False this is 0 because the BTS-16110 is the grandmaster.

UnreserveRequest

Request to unreserve the BTS-16110.

Field	Type	Description
vi	Session	Session information which contains the reservation token needed to access a reserved device.

UnreserveResponse

Response to the request to unreserve the BTS-16110.

Field	Type	Description
reply_information	ReplyInformation	General reply information.
is_reserved	bool	Returns True when the device is no longer reserved. Should always return False.

Scalar Value Types

.proto	Notes		C++	Java	Python	Go	C#	PHP	Ruby

Type								
double		double	double	float	float64	double	float	Float
float		float	float	float	float32	float	float	Float
int32	Uses variable-length encoding. Inefficient for encoding negative numbers – if your field is likely to have negative values, use sint32 instead.	int32	int	int	int32	int	integer	Bignum or Fixnum (as required)
int64	Uses variable-length encoding. Inefficient for encoding negative numbers – if your field is likely to have negative values, use sint64 instead.	int64	long	int/long	int64	long	integer/string	Bignum
uint32	Uses variable-length encoding.	uint32	int	int/long	uint32	uint	integer	Bignum or Fixnum (as required)
uint64	Uses variable-length encoding.	uint64	long	int/long	uint64	ulong	integer/string	Bignum or Fixnum (as required)
sint32	Uses variable-length encoding. Signed int value. These more efficiently encode negative numbers than regular int32s.	int32	int	int	int32	int	integer	Bignum or Fixnum (as required)
sint64	Uses variable-length encoding. Signed int value. These more efficiently encode negative numbers than regular int64s.	int64	long	int/long	int64	long	integer/string	Bignum
fixed32	Always four bytes. More efficient than uint32 if values are often greater than 2^28.	uint32	int	int	uint32	uint	integer	Bignum or Fixnum (as required)
fixed64	Always eight bytes. More efficient than uint64 if values are often greater than 2^56.	uint64	long	int/long	uint64	ulong	integer/string	Bignum
sfixed32	Always four bytes.	int32	int	int	int32	int	integer	Bignum or Fixnum (as required)
sfixed64	Always eight bytes.	int64	long	int/long	int64	long	integer/string	Bignum
bool		bool	boolean	boolean	bool	bool	boolean	TrueClass/FalseClass
string	A string must always contain UTF-8 encoded or 7-bit ASCII text.	string	String	str/unicode	string	string	string	String (UTF-8)
bytes	May contain any arbitrary sequence of bytes.	string	ByteString	str	[]byte	ByteString	string	String (ASCII-8BIT)