

Software Control of the Lanceometer

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Description

The Lanceometer is an analog to digital converter (ADC) with digital I/O based on the SmartStar product from www.zworld.com. The Lanceometer has the capability of sampling multiple channels according to a sampling schedule and returning a minimum, maximum, and average value of any channel upon request. All configuration and data retrieval can be done via a standard RS-232 port.

Scheduler Description

The Lanceometer has a sampling scheduler that is driven by a timer interrupt. The interrupt produces a scheduler tick that causes the scheduler to sample any of the ADC channels that are ready. The scheduler can also assert IO as necessary for certain ADC channels.

ADC Channel Description

The Lanceometer can have up to 50 ADC channels configured to sample analog signals at different rates. The Lanceometer scheduler checks every channel at regular intervals to see if it is time to sample that channel. The rate at which the scheduler checks on the channels is referred to as the scheduler tick rate. Each Lanceometer channel must be configured with the following information in order to be sampled.

Slot – The SmartStar backplane slot where the ADC card is located.

Channel – The specific ADC channel on the ADC card to use.

Period – The period in milliseconds to sample the ADC channel at.

Start Time – When to start sampling an ADC channel after a scheduler reset. This can be used to stagger or group ADC samples in time.

DO channel - A digital output to assert or de-assert while the ADC channel is being sampled.

The ADC channel can use the digital out channel zero if no digital output is required for that channel. Digital output channels need to be configured with the following information.

Slot – The SmartStar backplane slot where the digital IO card is located.

Channel – The specific output channel on the digital IO card to use.

Output state – The state the output should be in when the ADC channel that uses it is being sampled (i.e. 1 for asserted, 0 for de-asserted).

ADC channels can share DO channels. For instance ADC channels 4 through 7 could all use DO channel 2. What this means is that while any of the ADC channels is being sampled according to its schedule the associated DO channel will be asserted or de-asserted according to how it was configured.

Serial Interface

The serial interface uses a simple command response protocol. When a command is issued Lanceometer will attempt to execute that command. Upon successful execution the Lanceometer will return the characters

RDY<CR>

indicating that it is ready for the next command. If the Lanceometer is unable to execute the command successfully it will issue the characters

ERR ####<CR>
RDY<CR>

Where the '####' is a four digit error code. If the command is a request for information then the command will return the information requested followed by the characters

RDY<CR>

In all cases the Lanceometer will terminate a transaction with the characters

RDY<CR>

at which point it is ready for another command to be issued.

Lanceometer Commands

- GET DATA - Get averaged data from the Lanceometer.
- GET SAMPLE - Get an ADC sample from a configured channel.
- GET ADC - Get the configuration for an ADC channel.
- GET DO - Get the configuration for a digital out channel.
- GET IO - Get the state of a digital input.
- GET CONFIG - Get the current configuration for the Lanceometer.
- SET ADC - Set configuration parameters for an ADC channel.
- SET DO - Set configuration parameters for a digital out channel.
- SET IO - Assert a digital output not used by a digital out channel.
- CLEAR ADC - Clear the configuration of an ADC channel.
- CLEAR DO - Clear the configuration of a digital out channel.
- CLEAR IO - De-assert a digital output not used by a digital out channel.
- SCHED START - Start the Lanceometer sampling.
- SCHED STOP - Stop the Lanceometer from sampling.
- SCHED RESET - Reset the sampling schedule to its initial conditions.
- STORE - Store the configuration to nonvolatile memory.
- RESTORE - Set the configuration stored in nonvolatile memory to the current configuration.
- FORMAT_FLASH - Reformat the nonvolatile memory.
- ECHO - Put the Lanceometer serial port into an echo mode.
- VERS - Return the current version of the Lanceometer software.

Command Descriptions

GET DATA [channel | ALL]

Description

This command returns the data average for a specific ADC channel or for all active channels if the ALL parameter is used. When the data is retrieved from a channel all data for that channel is set back to its initial conditions (i.e. the average is cleared, the counts are cleared, etc.). If the ALL parameter is used the command will return the data for all configured ADC channels. While the data is being collected the sample scheduler will be temporarily suspended.

Returns

ADC DATA N## A#### C##### L##### H##### E# <cr>

where,

N – is the channel number

A – is the average sample value

C – is the total samples taken since the last time the data was retrieved

L – the lowest sample taken since the last time the data was retrieved

H – the highest sample taken since the last time the data was retrieved

E – a flag indicating an error occurred during sampling

GET SAMPLE [channel | ALL]

Description

This command returns a current sample from a configured ADC channel or samples all of the configured ADC channels if the ALL parameter is used. The samples taken are not part of the averaged data nor is the data for the channel that is sampled reset when the sample is taken. While a channel is being sampled the scheduler will be temporarily suspended.

Returns

ADC SAMPLE N## S##### <cr>

where,

N – is the channel number

S – is ADC value of the sample just taken

GET ADC [channel]

Description

This command returns the current configuration of an ADC channel. While the channel configuration is being determined the sample scheduler will be temporarily suspended.

Returns

ADC N## S## C## P##### T##### D# A#<cr>

where,

N – is the channel number

S – the slot in the SmartStar backplane where the ADC card is located

C – the channel on the ADC card that is to be used

P – the period in milliseconds that the scheduler will sample the channel

T – the initial sample time in milliseconds that the scheduler will use upon reset

D – the digital out channel associated with this ADC channel

A – a flag indicating whether this channel is configured (0 not configured, 1 configured)

GET DO [channel]

Description

This command returns the current configuration of a digital out channel. While the channel configuration is being determined the sample scheduler will be temporarily suspended.

Returns

DO N## S## C## O# A#<cr>

where,

N – is the channel number

S – the slot in the SmartStar backplane where the IO card is located

C – the channel on the IO card that is to be used

O – output state during sample time (i.e. 1 for asserted, 0 for de-asserted)

A – a flag indicating whether this channel is configured (0 not configured, 1 configured)

GET IO S[slot] C[channel]

Description

This command returns the state of a digital input.

Returns

IO S## C## I#<cr>

where,

S – the slot in the SmartStar backplane where the IO card is located

C – the channel on the IO card that is to be sampled

I – input state during sample time

GET CONFIG

Description

The GET CONFIG command returns the current configuration of all active ADC and DO channels. If the optional ALL parameter is used the command will return the state of all ADC and DO channels whether active or not. While the channel configuration is being determined the sample scheduler will be temporarily suspended

Returns

ADC N## S## C## P##### T##### D# A#

...

DO N## S## C## O# A#

where,

N – is the channel number

S – the slot in the SmartStar backplane where the ADC card is located

C – the channel on the ADC card that is to be used

P – the period in milliseconds that the scheduler will sample the channel

T – the initial sample time in milliseconds that the scheduler will use upon reset

D – the digital out channel associated with this ADC channel

O – output state during sample time (i.e. 1 for asserted, 0 for de-asserted)

A – a flag indicating whether this channel is configured (0 not configured, 1 configured)

```
SET ADC N[adc_channel] S[slot] C[channel] P[period] T[start_time] D[dig_out]
```

Description

This command sets the configuration of an ADC channel. The sample scheduler will be reset to its initial state when an ADC channel is set. The SET ADC command requires the following parameters

N – is the channel number

S – the slot in the SmartStar backplane where the ADC card is located

C – the channel on the ADC card that is to be used

P – the period in milliseconds that the scheduler will sample the channel

T – the initial sample time in milliseconds that the scheduler will use upon reset

D – the digital out channel associated with this ADC channel

Returns

none

```
SET DO N[adc_channel] S[slot] C[channel] O[outout]
```

Description

This command sets the configuration of a DO channel. The sample scheduler will be temporarily suspended while the DO channel is being set. The SET DO command requires the following parameters

N – is the channel number

S – the slot in the SmartStar backplane where the IO card is located

C – the channel on the IO card that is to be used

O – output state during sample time (i.e. 1 for asserted, 0 for de-asserted)

Returns

none

SET IO S[slot] C[channel]

Description

This command asserts a digital output that is not current in use by a DO channel. While the IO channel is being asserted the sample scheduler will temporarily be suspended.

Returns

None

CLEAR ADC [channel | ALL]

Description

This command clears the configuration of an ADC channel and puts that channel in an in-active state. If the ALL parameter is used all of the configured ADC channels will be cleared. While the channel configuration is being cleared the sample scheduler will be temporarily suspended.

Returns

none

CLEAR ADC [channel | ALL]

Description

This command clears the configuration of a DO channel and puts that channel in an in-active state. If the ALL parameter is used all of the configured DO channels will be cleared. While the channel configuration is being cleared the sample scheduler will be temporarily suspended.

Returns

None

CLEAR IO S[slot] C[channel]

Description

This command de-asserts a digital output that is not current in use by a DO channel. While the output channel is being de-asserted the sample scheduler will temporarily be suspended.

Returns

none

SCHED START

Description

The SCHED START command starts the Lanceometer sample scheduler sampling.

Returns

none

SCHED STOP

Description

The SCHED STOP command stops the Lanceometer sample scheduler from sampling.

Returns

none

SCHED RESET

Description

The SCHED RESET command resets the Lanceometer sample scheduler to its initial conditions.

Returns

none

STORE

Description

This command stores the current configuration of ADC and DO channels to non-volatile memory.

Returns

none

RESTORE

Description

This command sets the ADC and DO channels to the configuration stored in non-volatile memory.

Returns

none

FORMAT_FLASH

Description

This command is used to format corrupt flash memory on the SmartStar CPU. This command should not be required during normal operation of the Lanceometer and should only be necessary to recover a system that has a corrupt configuration.

Returns

none

ECHO

Description

This command toggles the state of the echo mode. When echo mode is set all characters sent to the Lanceometer serial port will be echoed back and linefeeds will be appended to all carriage returns. This command is for the convenience of humans when accessing the Lanceometer via a terminal program. The Lanceometer will always start from reset with the echo mode cleared.

Returns

none

VERS

Description

This command returns the current version of the Lanceometer software.

Returns

LANCEOMETER REV #.#<cr>

Error Code Description

ERR 0001 – General failure.

ERR 0004 – No command match.

ERR 0005 – No sub-command match.

ERR 0100 – ADC index parameter required.

ERR 0101 – DO index parameter required.

ERR 0102 – Slot parameter required.

ERR 0103 – Channel parameter required.

ERR 0104 – Sample period parameter required.

ERR 0105 – Start time parameter required.

ERR 0106 – Digital out channel parameter required.

ERR 0107 – Digital out sample state parameter required.

ERR 0200 – Slot channel combination already in use.

ERR 0201 – Slot requested out of range.

ERR 0202 – Channel requested out of range.

ERR 0203 – Sample period requested out of range.

ERR 0204 – Sample start time requested out of range.

ERR 0205 – ADC channel index requested out of range.

ERR 0206 – Digital out channel index requested out of range.

ERR 0207 – ADC index requested already in use.

ERR 0208 – Digital out channel requested already in use.

ERR 0209 – Digital out sample state requested invalid(i.e. 1 for asserted, 0 for de-asserted)

ERR 0210 – ADC channel requested not active.

ERR 0300 – Bad channel configuration.

ERR 0301 – Failure opening configuration file.

ERR 0302 – Failure reading configuration file.

ERR 0303 – Bad checksum on configuration file.

ERR 0304 – Failure while attempting to write configuration file.

ERR 0305 – Failure while attempting to create configuration file.

ERR 0306 – Failure initializing filesystem.

ERR 0307 – Failure formatting filesystem.