Thank you for purchasing LONWORKS Option Board.

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# SAFETY PRECAUTIONS

</div>

- Always follow safety instructions to prevent accidents and potential hazards from occurring.

- Safety precautions are classified into "WARNING" and "CAUTION" and their meanings are as follows:

⚠ **WARNING**  Improper operation may result in serious personal injury or death.

⚠ **CAUTION**  Improper operation may result in slight to medium personal injury or property damage.

- The indicated illustrations on the product and in the manual have the following meanings.

⚠  Danger may be present. Read the message and follow the instructions carefully.

⚡  Particular attention should be paid because danger of an electric shock may be present.

- Keep operating instructions handy for quick reference.
- Read the operating instructions carefully to fully understand the functions of the SV-iP5A series and to use it properly.

<div style="border: 1px solid black; text-align: center;">

# ⚠  CAUTION

</div>

- **Be cautious, when handling the CMOS components of the Option Board.**

  Static may lead to malfunctioning of the product.

- **Turn off the inverter power, when changing the communication cable.**

  Otherwise, you may damage the board or a communication error may occur.

- **Make sure to insert the Option Board connector to the inverter precisely.**

  Otherwise, you may damage the board or a communication error may occur.

- **Check the parameter unit before setting up the parameter.**

  Otherwise, a communication error may occur.

## 1. Introduction

LONWORKS technology was born in Echelon Co. LONWORKS Network is generally used for factory or building automation. There is no Master/Slave concept in the LONWORKS network but all the nodes (devices) communicate with each other through LONTalk protocol. And LONWORKS nodes don't have dependence on other manufacturers. The independence is only available by using Standard Network Variable Type (SNVT), which is provided by LONWORKS. The iP5A LONWORKS communication card also supports the Standard Network Variable type variables.

All network variables have input and output variables. Data communication will automatically get started when you connect the input and output variables with the Installation Tool. To connect input variables with output variables, their types of the network should be identical.

## 2. Technical features of LONWORKS

| Protocol | LonTalk |
|---|---|
| LONWORKS Com. Chip | FT3150-P20 chip from Echelon |
| LONWORKS transceiver | FT-X1 |
| Data types | Peer-to-peer communication |
| LONWORKS connector | Pluggable connector |
| Channel Type | TP/FT-10 |
| Transfer cable | Free Topology Twisted Pair |
| Baud rate | 78 Kbit/s |
| Topology | Free Topology (Bus, Star, Loop, or compound of the previous) |

**3. Guidelines to install**

Refer to the Quick Guide below to install iP5A LONWORKS communication card.

1) Open the package of the iP5A LONWORKS and check the communication card for external damages.

2) Verify the function of iP5A with the power connected whether the functions operate well or not. And check inverter operation by operating keypad.

3) Turn the power of iP5A off and wait at least 5 minutes until the voltage of the inverter gets discharged. Check if the voltage level is in a safe range by measuring the DC link voltage.

4) Install the iP5A LONWORKS communication card to an iP5A inverter.

    4-1) Uncover the iP5A inverter and mount the iP5A LONWORKS communication card

    4-2) Connect communication cable (A, B). Connect the cable not considering polarity, for LONWORKS communication cable has no polarity.

    4-3) If the node is located at the end of the network, use the terminal resistance selection switch to set the terminal.

5) Download an external interface file (iP5A LON.XIF) and a resource file to configure LONWORKS communication card. You can download the files from our homepage http://www.lsis.biz .

6) Turn on the power of inverter and verify COM-01 Opt B/D with the iP5A keypad whether it is automatically set to LonWorks or not.

7) Set the related parameters of LONWORKS communication.

8) Examine LED status of the iP5A LONWORKS communication card. SERVICE LED will blink by 0.5Hz if you didn't configure the card.

9) Wait at least 5 minutes after the iP5A is turned off to discharge DC Link voltage. It is the end of the installation, cover up the lid of the inverter.

10) Turn on the iP5A again and set up the configuration with Network Tool.


    Cf.) You must set up the configuration before you try to communicate by LONWORKS communication. It is not available to communicate with LONWORKS communication without the configuration.


11) Turn the SVC switch on and off to configure the communication.


12) When the configuration is finished successfully, the SERVICE LED will be turned off.

## 4. Network connection

iP5A LONWORKS communication card offers a pluggable connector.

This table describes about the connector. LONWORKS communication cable should be connected to No. 1 and 2 of the connector. You may connect the cable without considering polarity because LONWORKS communication has no polarity.

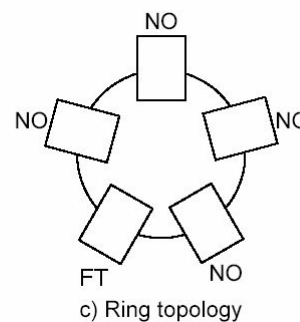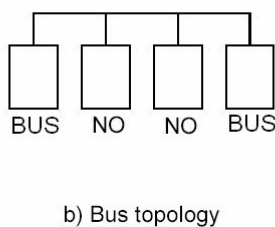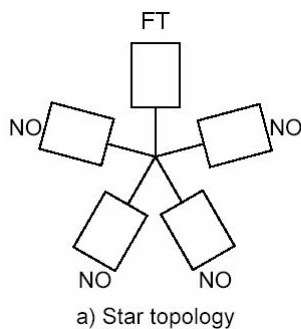| Switch location | | Terminal type |
|---|---|---|
| 1 | A | Network cable connection (No polarity) |
| 2 | B | |
| 3 | S | Shield connection |

## 5. Network Termination

Set up the terminal to guarantee the reliability of communication data.

You may set up the terminal of communication cards at both ends (BUS Topology) or a communication card at one side (Free Topology).

iP5A LONWORKS communication card contains a terminal resistance. You may determine whether you will use a terminal resistance by DIP switch in the iP5A LONWORKS communication card. Set up one or two terminal resistances according to network topology. Free Topology uses 500Ω resistance. And there is one LONWORKS device that is terminated with a resistance in the network. In case of Bus Topology, it has 100Ω as a terminal resistance and two LONWORKS devices.

This table describes terminal types according to the location of the switch.

| Switch location | Terminal type |
|---|---|
| FT | Free Topology<br>50Ω terminal resistance<br>Set up one terminal for LONWORKS communication card of the network |
| NO | No use of terminal resistance |
| BUS | Bus Topology<br>105Ω terminal resistance<br>Set up two terminals for LONWORKS communication card of the network. |



a) Star topology          b) Bus topology          c) Ring topology

Terminal types of network topologies

① No use of the terminal      ② Free Topology terminal      ③ Bus Topology terminal (100 Ω)
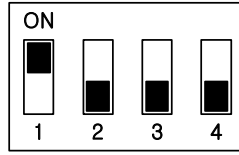
Terminal switch configurations of iP5A LONWORKS communication card

## 6. Network cable

✓ Belden 85102, unshielded

✓ Belden 8471, unshielded

✓ Level IV 22AWG, unshielded

✓ JY (St) Y 2x2x0.8, shielded

✓ TIA568A Cat.5 24AWG

7. **Keypad parameters of LONWORKS**

These are inverter parameters that display information of LONWORKS.
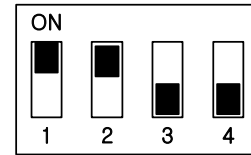
| Keypad parameters of iP5A LONWORKS | | |
|---|---|---|
| **Code Number** | **Parameter** | **Details** |
| COM-01 | Opt B/D | It displays the name of the communication card that has been installed on the inverter. (It indicates 'LonWorks' when a LONWORKS communication card is installed.) |
| COM-03 | Opt Version | It displays the version of the communication card. |
| COM-61 | Opt Para-1 | Display Neuron ID 1 (Decimal, MSB) |
| COM-62 | Opt Para-2 | Display Neuron ID 2 (Decimal) |
| COM-63 | Opt Para-3 | Display Neuron ID 3 (Decimal) |
| COM-64 | Opt Para-4 | Display Neuron ID 4 (Decimal) |
| COM-65 | Opt Para-5 | Display Neuron ID 5 (Decimal) |
| COM-66 | Opt Para-6 | Display Neuron ID 6 (Decimal) |
| COM-67 | Comm UpDate | Update keypad parameters of communication |

**(1) Option Type (Option card information, COM-01)**

It automatically displays the type of the communication card on iP5A. It indicates 'LonWorks' when a LONWORKS communication card is installed.

**(2) Option Version (Option version information, COM-02)**

It automatically displays the version of communication card on iP5A.

**(3) Neuron ID1~6 (COM61~66)**

Neuron ID is a 6 bytes value which displays the Neuron ID of Neuron Chip on the keypad. It is displayed by decimal numeration.

**(4)** **Comm UpDate (COM-67)**

When modifying the parameter that is related to the configuration variables of the drive object on the keypad, you have to set the Comm UpDate to "Yes," in order to write it on the communication card. Comm UpDate automatically changes to "No."

The keypad parameters to apply Comm UpDate are as follows.

| Code | Code Description |
|------|------------------|
| DRV-03 | Acc. Time |
| DRV-04 | Dec. Time |
| FU1-30 | Max Frequency |
| FU1-31 | Base Frequency |
| FU1-32 | Start Frequency |
| FU2-41 | Pole Number |

After finishing the commission to LONWORKS communication card, you had better set COM-67 Comm Update 'Yes' or input 1 to nciCommUpDate of User Object. Follow this process, Configuration Property can be applied with the value of the Keypad.

**8. Functional Profile**

8.1 **Node Object**
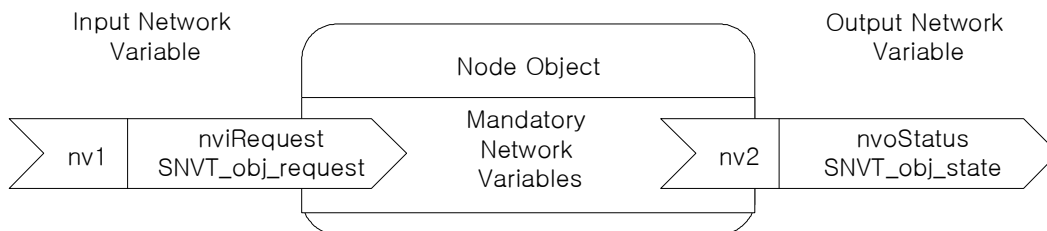


**8.1.1 Network Input Variables**

| Function | Variable | SNVT Type | Min. value | Max. value |
|---|---|---|---|---|
| Node Object Request | nviRequest | SNVT_obj_request | - | - |

**(1) nviRequest**

This input is used to enable control commands and updates to and from network (RQ_ENABLE, RQ_DISABLE) and in parallel to reset faults of the drive (RQ_CLEAR_ALARM). RQ_DISABLE stops the drive with the selected stop mode and disables node operation. In addition requests RQ_NORMAL, RQ_CLEAR_STATUS, RQ_UPDATE_STATUS and RQ_REPORT_MASK are supported.

**8.1.2 Network Output Variables**

| Function | Variable | SNVT Type | Min. value | Max. value |
|---|---|---|---|---|
| Node Object Status | nvoStatus | SNVT_obj_status | - | - |

**(1) nvoStatus**

This nvoStatus reports node object status.

| | |
|---|---|
| Invalid ID | Invalid node ID requested |
| Report mask | Reporting supported fields. |
| Disabled | If RQ_DISABLE active |
| Electrical_fault | Drive is faulted |
| Manual_control | Drive is in local control |
| In_alarm | Drive has an alarm |

## 8.2 Drive Object

Input Network
Variable

Variable Speed Motor
Drive (6010)

Output Network
Variable

| nv1 | nviDrvSpeedStpt
SNVT_switch |

Mandatory
Network
Variables

| nv4 | nvoDrvSpeed
SNVT_lev_percent |

| nv3 | nvoDrvCurrent
SNVT_amp |

| nv2 | nviDrvSpeedScale
SNVT_lev_percent |

Optional
Network
Variables

| nv5 | nvoDrvVolt
SNVT_volt |

| nv6 | nvoDrvPwr
SNVT_power_kilo |

| nv7 | nvoDrvRunHours
SNVT_time_hour |

### Configuration Properties

nc17    nciLocation (Optional)
nc50    nciMaxSpeed (Mandatory)
nc53    nciMinSpeed (Mandatory)
nc48    nciRcvHrtBt (Optional)
nc49    nciSndHrtBt (Mandatory)
nc52    nciMinOutTm (Optional)
nc158 nciNmlSpeed (Mandatory)
nc159 nciNmlFreq (Mandatory)
nc160 nciRampUpTm (Mandatory)
nc161 nciRampDownTm (Mandatory)
nc162 nciDrvSpeedScale (Optional)

### 8.2.1 Network Input Variables

| Function | Variable | SNVT Type | Min. value | Max. value |
|---|---|---|---|---|
| Drive Speed Setpoint | nviDrivSpeedStpt | SNVT_switch | n/a | n/a |
| Drive Speed Setpoint Scaling | nviDrvSpeedScale | SNVT_lev_percent | 163.840% | 163.840% |

**(1) nviDrvSpeedStpt**

**(2) nviDrvSpeedScale**

**▲ Definition**

Network input SNVT_switch        nviDrivSpeedStpt

Network input SNVT_lev_percent        nviDrvSpeedScale

**▲ Description**

NviDrvSpeedStpt and nviDrvSpeedScale are used for the inverter run and speed command.

The state variable of nviDrvSpeedStpt is a value that decides the command to whether run or stop the inverter.

If the state of nviDrvSpeedStpt is 0, the inverter will stop and the inverter will run when the state value is 1.

nviDrvSpeedScale offers information of the operative direction. If a value of the nviDrvSpeedScale is positive, the motor runs clockwise and if the nviDrvSpeedScale is negative, the motor runs counterclockwise.

Frequency command consists of a combination of nviDrvSpeedScale and nviDrvSpeedStpt. The value of both nviDrvSpeedScale and nviDrvSpeedStpt are in % units and the multiplied value of the two is the input for the frequency command of Base Freq. nviDrvSpeedScale provides the scale information of nviDrvSpeedStpt value. For example, if nviDrvSpeedStpt is 100% and nviDrvSpeedScale is -80%, the actual speed is -80% (1 X 0.8 = 0.8). Therefore, the inverter runs counterclockwise at a speed of the base frequency times 0.8. So, if the base frequency is 60.00 Hz, the frequency command value would be 48Hz (60.00Hz X 0.8).

The input range for nviDrvSpeedScale is -163.840% ~ 163.830%. Therefore, if a value of 0x7fff(+163.835%) is put in, this value would be a invalid data.

**State and Value information of NviDrvSpeedStpt**

| State | Value | Run frequency / status of inverter |
|---|---|---|
| 0 | - | Stop |
| 1 | 0 | 0% frequency operation of the base frequency |
| 1 | 0.5~100.0 | 0.5~100.0% frequency operation of the base frequency |
| 1 | 100.0 | 100% frequency operation of the base frequency |
| 0xFF | - | Auto |

When you want to do the run or the frequency command with LONWORKS, you should set up the COM-02 Opt mode of the COM group to "Cmd + Freq" by using the keypad. Set the COM-02 Opt mode to "Command" to operate the run command only with LONWORKS and "Freq" is for the use of the frequency command.

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| COM-02 | Opt mode | None | None |
| | | | Command |
| | | | Freq |
| | | | Cmd + Freq |

nviDrvSpeedScale Range          -163.840% ~ 163.830%

nviDrvSpeedScale Default         0.000%

▲ **Inverter parameters of NviDrvSpeedStpt, nviDrvSpeedScale**

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| 0x0005 | Frequency Command | 0.00 Hz | 0.00 ~ 120.00 |
| 0x0006 | Run Command | Refer to the description of common area | |
| FU1-31 | Base Frequency | 60.00 Hz | 30.00~120.00 |

Cf.) You may use Lost Command by using the nciRcvHrtBt variable

### 8.2.2 Network Output Variables

| Function | Variable | SNVT Type | Min. value | Max. value |
|---|---|---|---|---|
| Drive Speed Feedback | nvoDrvSpeed | SNVT_lev_percent | 163.840% | 163.840% |
| Actual Motor Current | nvoDrvCurnt | SNVT_amp | 0.0A | 3276.7A |
| Drive Output Voltage | nvoDrvVolt | SNVT_volt | 0.0V | 3276.7V |
| Actual Drive Power | nvoDrvPwr | SNVT_power_kilo | 0.0kW | 6553.5kW |
| Drive total running hours | nvoDrvRunHours | SNVT_time_hour | 0h | 65535h |

**(1) nvoDrvSpeed**

**▲ Definition**

Network output SNVT_lev_percent                    nvoDrvSpeed

**▲ Description**

nvoDrvSpeed outputs the inverter's current run speed by the percentage value of the base frequency. When the inverter runs clockwise (counterclockwise), the value of the nvoDrvSpeed gets a positive (negative) value. For example, if the base frequency is 60.00Hz and the inverter is running counterclockwise with 30.00Hz, novDrvSpeed outputs the value of -50.00%.

Typical Range          -163.840 ~ 163.830 % (0.001 %)

**▲ Inverter parameters for nvoDrvSpeed**

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| DRV-00 0x000A | Output Frequency | | - |
| 0x000E | Status of Inverter   (FWD, REV) | | |
| FU1-31 | Base Frequency | 60.00 Hz | 30.00~120.00 |

**(2) nvoDrvCurnt**

**▲ Definition**

Network output SNVT_amp                  nvoDrvCurnt

**▲ Description**

nvoDrvCurnt displays the output current value of the inverter by the unit of the A.

Typical Range          0.0 ~ 3276.6 A (0.1 A)

▲ **Inverter parameters for nvoDrvCurnt**

| Code Number/ Common area address | Code Description |
|---|---|
| DRV-08 0x0009 | Current |

**(3) nvoDrvVolt**

▲ **Definition**

Network output SNVT_volt                 nvoDrvVolt

▲ **Description**

nvoDrvVolt displays the output voltage value of the inverter by the unit of V.

Typical Range          0.0 ~ 700.0 V (0.1 V)

▲ **Inverter parameters for nvoDrvVoltCurnt**

| Code Number/ Common area address | Code Description |
|---|---|
| DRV-11 0x000B | Voltage |

**(4) nvoDrvPwr**

▲ **Definition**

Network output SNVT_power_kilo         nvoDrvPwr

▲ **Description**

nvoDrvPwr, the value of a network output variable, displays the output power of the inverter by the unit of kW.

Typical Range          0.0 ~ 6553.4 kW (0.1 kW)

▲ **Inverter parameters for nvoDrvPwr**

| Code Number/ Common area address | Code Description |
|---|---|
| MAK-01 0x0001 | Capacity of the inverter |

**(5) nvoDrvRunHours**

**▲ Definition**

Network output SNVT_time_hournvoDrvRunHours

**▲ Description**

It displays the whole operation time of the inverter.

**▲ Inverter parameters for nvoDrvPwr**

| Code Number/ Common area address | Code Description |
|---|---|
| FU2-85 | Whole operation time |

**8.2.3** **Network Configuration Variable**

| Function | Variable | Optional/ Mandatory | SNVT Type |
|---|---|---|---|
| Location Lable | nciLocation | Optional | SCPTlocation |
| Maximum Motor Speed | nciMaxSpeed | Mandatory | SCPTmaxSetpoint |
| Minimum Motor Speed | nciMinSpeed | Mandatory | SCPTminSetpoint |
| Receive Heartbeat Time | nciRcvHrtBt | Optional | SCPTmaxRcvTime |
| Send Heartbeat Time | nciSndHrtBt | Mandatory | SCPTmaxSndTime |
| Minimum Send Time | nciMinOutTm | Optional | SCPTMinOutTime |
| Nominal Motor Speed in RPM | nciNmlSpeed | Mandatory | SCPTnomRPM |
| Nominal Motor Frequency | nciNmlFreq | Mandatory | SCPTnomFreq |
| Minimum Ramp Up Time | nciRampUpTm | Mandatory | SCPTrampUPTm |
| Minimum Ramp Down Time | nciRampDownTm | Mandatory | SCPTrampDownTm |
| Default Value for nviDrvSpeedScale | nciDrvSpeedScale | Optional | SCPTdefScale |

Cf.) When you modify the parameter that is related to the configuration variable and set Comm UpDate parameter to 'Yes', the modified value gets written to the configuration variable.

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| COM-67 | Comm UpDate | No | No Yes |

**(1) Location Label (Optional)**

**▲ Definition**

Network config input SNVT_str_asc        nciLocation

**▲ Description**

nciLocation uses 6bytes Location string of Neuron Chip and saves the information of the physical location into nciLocation.

Default                Empty spaces

**(2) Maximum Motor Speed (Mandatory)**

**▲ Definition**

Network config input SNVT_lev_percent                nciMaxSpeed

**▲ Description**

nciMaxSpeed is the value to set the max speed of the motor. nciMaxSpeed is inputted by the percentage of the nominal frequency (nciNmlFreq) configuration value. For example, if nciNmlFreq is 60.0Hz and nciMaxSpeed is 120%, the maximum frequency will be 72.0Hz (60.0 X 1.2). The value, 72.0Hz, is written in the FU1-30 Max Freq and it will be shown on the keypad.

nciMaxSpeed value is not able to modify while the inverter runs. You should stop the inverter first then you can modify the nciMaxSpeed value.

The initial value of the nciMaxSpeed is the percentage value of the FU1-30 Max Freq, which compares to the FU1-31 Base Freq. Therefore, the initial value of the nciMaxSpeed will be 100.00%.

nciMaxSpeed must satisfy the formula below.

$$-163.840 \ \leq \ Minimum \ \ Speed \ \leq \ Maximum \ \ Speed \ \ \leq \ 163.840$$

Typical Range          100.000 ~ 150.000 % (0.001%)

Default                    100.000%

**▲ Inverter parameters for nciMaxSpeed**

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| FU1-31 | Base Frequency | 60.00 Hz | 30.00 ~ 120.00 |
| FU1-30 | Max Frequency | 60.00 Hz | 30.00 ~ 120.00 |

※ When you input the FU1-30 Max Freq value and set Comm Update as 'Yes' to apply the nciMaxSpeed value and if the FU1-30 Max Freq is more than 160% of the FU1-31 Base Freq, FU1-30 Max Freq value is changed to 100% of the Base Freq. For example, if the Base Freq is 60.00 Hz, the Max Freq is 120.00 Hz, and Comm Update is 'Yes', then the Max Freq will be automatically changed to 60.00 Hz.

**(3) Minimum Motor Speed (Mandatory)**

▲ **Definition**

Network config input SNVT_lev_percent        nciMinSpeed

▲ **Description**

nciMinSpeed is the value to set the min speed of the motor. nciMinSpeed is inputted by the percentage of the nominal frequency (nciNmlFreq) configuration value. For example, if nciNmlFreq is 60.0Hz and nciMinSpeed is 10%, the maximum frequency will be 6.0Hz (60.0 X 0.1). The value, 6.00Hz, is written in the FU1-32 Start Freq and it will be shown on the keypad.

nciMinSpeed value is not able to modify while the inverter runs. You should stop the inverter first and then modify the nciMinSpeed value.

The initial value of the nciMinSpeed is the percentage value of the FU1-32 Start Freq, which compares to the FU1-31 Base Freq. Therefore, the initial value of the nciMaxSpeed will be 0.8%.

nciMInSpeed must satisfy the formula below.

$$-163.840 \ \leq \ Minimum \ \ Speed \ \ \leq \ \ Maximum \ \ Speed \ \ \leq \ 163.840$$

Typical Range        0.000 ~ 40.000 % (0.001 %)

Default        0.000%

▲ **Inverter parameters for nciMaxSpeed**

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| FU1-31 | Base Frequency | 60.00 Hz | 30.00 ~ 120.00 |
| FU1-32 | Start Frequency | 0.50 Hz | 0.01 ~ 10.00 |

**(4) Receive Heart Beat Time (Optional)**

**▲ Definition**

Network config input SNVT_time_sec        nciRcvHrtBt

**▲ Description**

Decide the maximum update cycle time of the network input variables, nviDrvSpeedStpt and nviDrvSpdScale. If Update of nviDrvSpeedStpt and nviDrvSpdScale does not occur during the nciRcvHrBt time, it recognizes it as a condition of the communication command loss and starts to run as the mode in the communication command loss of IO-93.

If you want to run with the mode which is set in the communication command loss, you have to set the COM-02 Opt mode as a value, not "None." Furthermore, the IO-92 Lost Cmd mode has to be set as a value also.

Typical Range          0.0 ~ 120.0 sec (0.1 sec)

                       Invalid Data, when input value is 0xFFFF(6553.5 sec)

Default                0.0 sec (not using Receive Heart Beat function)

**▲ Inverter parameters for nciRcvHrtBt**

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| IO-92 | COM Lost Cmd | None | None |
| | | | FreeRun |
| | | | Stop |
| COM-02 | Opt mode | None | None |
| | | | Cmd |
| | | | Freq |
| | | | Cmd+Freq |

Caution) When communicating with LONWORKS, communication loss time of the inverter, IO-93 COM Time Out value, does not get applied.

**(5) Send Heart Beat Time(Mandatory)**

**▲ Definition**

Network config input SNVT_time_sec        nciSndHrtBt

**▲ Description**

It determines the maximum output time of the network output variables, such as nvoDrvSpeed, nvoDrvCurnt, nvoDrvVolt, nvoDrvPwr, and nvoDrvRunHours.

Typical Range          0.0 ~ 6553.4 sec

                        Invalid Data, when input value is 0xFFFF(6553.5 sec)

Default                 0.0 sec (not using Send Heart Beat function)

**(6) Minimum Out Time (Optional)**

**▲ Definition**

Network config input SNVT_time_sec        nciMinOUtTm

**▲ Description**

It decides the min. time that network variables, such as nvoDrvSpeed, nvoDrvCurnt, nvoDrvVolt, nvoDrvPwr, and nvoDrvRunHours have to wait until they get sent through communication.

The network value does not change by every little variation but it sends out the changed value every nciMinOutTm time. It is used to reduce network traffic.

Typical Range          0.0 ~ 6553.4 sec (0.1 sec)

                        Invalid Data, when input value is 0xFFFF(6553.5 sec)

Default                 0.0 sec (not using Minimum Out Time function)

**(7) Nominal Motor Speed in RPM (Mandatory)**

**▲ Definition**

Network config input SNVT_freq_hz          nciNmlSpeed

**▲ Description**

nciNmlSpeed sets up the Base Freq of inverter.

The initial value of nciNmlSpeed will become 1800.00 rpm because it is converted from FU1-31 Base Freq into rpm (Base on 60Hz of the Base Freq and 4 Pole Number). When the nciNmlSpeed value is modified, the value of nciNmlSpeed, which is converted from rpm into Hz is reflected in FU1-31 Base Freq.

The below is the formula to convert RPM into Hz. The inverter parameter, M2-10 Pole Num, means the pole number of the motor. You should set it properly.

$$\text{The number of rotation per minute} = \frac{\text{Base Frequency(Hz)} \times 120}{\text{the number of motor poles}}$$

Valid Range          0 ~ 65534 rpm (1 rpm)

Default          1800 rpm

**▲ Inverter parameters for nciNmlSpeed**

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| FU2-41 0X0017 | Pole Number | 4 | 2~48 |
| FU1-31 | Base Frequency | 60.00 Hz | 30.00 ~ 120.00 |

**▲ Caution**

nciNmlFreq is automatically changed when you modify nciNmlSpeed. For example, when nciNmlSpeed is 1800rpm, nciNmlFreq is 60.0Hz, FU1-31 Base Frequency of Keypad parameter is 60.00Hz, and BAS-11 Pole Number is 4, and if you change nciNmlFreq to 1700rpm, then nciNmlFreq will be 56.7Hz(FU1-31 Base Frequency is rounded up) and FU1-31 Base Frequency of Keypad parameter will be 56.66Hz.

DRV-19 Start Frequency and DRV-20 Max Frequency will be changed together when you modify nciNmlSpeed and nciNmlFreq. Referring to the above example, if nciMaxSpeed is 100.000% and nciMinSpeend is 10.000%, DRV-19 Start Frequency will become 5.66Hz and DRV-20 Max Frequency will be 56.66Hz.

**(8) Nominal Motor Frequency (Mandatory)**

**▲ Definition**

Network config input SNVT_freq_hz        nciNmlFreq

**▲ Description**

nciNmlFreq sets up the Base Freq of inverter. The nciNmlFreq is a indispensable value to set the minimum(nciMinSpeed) and maximum(nciMaxSpeed) frequency of the motor. nciMinSpeed and nciMaxSpeed are percentage values of the nciNmlFreq. The initial value of nciNmlFreq is 60.0Hz, which is same as FU1-31 Base Freq.

Valid Range        30.0~400.0 (0.1 Hz)

Default        60.0 Hz

**▲ Inverter parameters for nciNmlFreq**

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| FU1-31 | Base Frequency | 60.00 Hz | 30.00 ~ 120.00 |

**(9) Minimum Ramp Up Time (Mandatory)**

**▲ Definition**

Network config input SNVT_time_sec        nciRampUpTm

**▲ Description**

nciRampUpTm sets up the acceleration time. DRV-03 Acc. Time value will be changed into nciRampUpTm when nciRampUpTm is modified. The initial value of the nciRampUpTm is same as DRV-03 ACC. Time. Therefore, the initial value is 20.0 sec.

Valid Range        0.0~600.0 sec (0.1 sec)

Default        20.0 sec

**▲ Inverter parameters for nciRampUpTm**

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| 0x0007/DRV-03 | Acc. Time | 20.0 sec | 0.0 ~ 600.0 |

**(10) Minimun Ramp Down Time (Mandatory)**

**▲ Definition**

Network config input SNVT_time_sec nciRampDownTm

▲ **Description**

nciRampDownTm sets up the deceleration time. DRV-04 Dec. Time value will be changed into nciRampDownTm when nciRampDownTm is modified.

The initial value of nciRampDownTm is same as DRV-04 Dcc.Time. Therefore, the initial value is 30.0 sec.

Valid Range          0.0 ~ 600.0 sec (0.1 sec)

Default              30.0 sec

▲ **Inverter parameters for nciRampDownTm**

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| 0x0008 DRV-04 | Dec. Time | 30.0 sec | 0.0 ~ 600.0 |

**(11) Default for nviDrvSpeedScale (Optional)**

▲ **Definition**

Network config input SNVT_lev_percent nciDrvSpeedScale

▲ **Description**

nciDrvSpeedScale is applied to the initial value of the network output variable, nviDrvSpeedScale.

Valid Range          -163.840 ~ 163.830 (0.005 %)

Default              0.000 %

Cf.) FU1-31 Base Freq, FU1-30 Max Freq, FU1-32 Start Freq, FU2-41 Pole Num, DRV-01 Acc Time, and DRV-02 Dec Time are keypad parameters that are closely related to the configuration property variables of drive object, such as nciNmlFreq, nciNmlSpeed, nciMaxSpeed, nciMinSpeed, nciRampUPTm, and nciRampDownTm.

To modify FU1-31 Base Freq, FU1-30 Max Freq, FU1-32 Start Freq, FU2-41 Pole Num, DRV-01 Acc Time, and DRV-02 Dec Time and save them into the configuration property variables, such as nciNmlFreq, nciNmlSpeed, nciMaxSpeed, nciMinSpeed, nciRampUPTm, and nciRampDownTm, turn off the inverter and turn it on again.

For example, if you change the keypad parameters as the table below, nciMaxSpeed is 120.000%, nciMinSpeed is 20.000%, nciNmlSpeed is 15000 rpm, nciNmlFreq is 50.0 Hz, nciRampUpTm is 19.0 sec, and nciRampDownTm is 29.0 sec.

| Code | Parameter | Value | Code | Parameter | Value |
|--------|-----------|----------|--------|-----------|----------|
| DRV-01 | Acc. Time | 19.0 sec | DRV-02 | Dec. Time | 29.0 sec |
| FU1-30 | Max Freq | 60.00 Hz | FU1-31 | Base Freq | 49.99 Hz |
| FU1-32 | Start Freq | 10.00 Hz | FU2-41 | Pole Num | 4 |

① nciNmlFreq is down to the first decimal place and FU1-31 Base Freq is down to the second decimal place. Therefore, the nciNmlFreq is 45.7Hz, because it rounds off at the second decimal place of FU1-31.

$$② \ \text{nciNmlSpeed} = \frac{\text{BaseFreq} \times 120}{\text{the number of motor ploes}} = \frac{45.68 \times 120}{4} = 1370 rpm (1370.4)$$

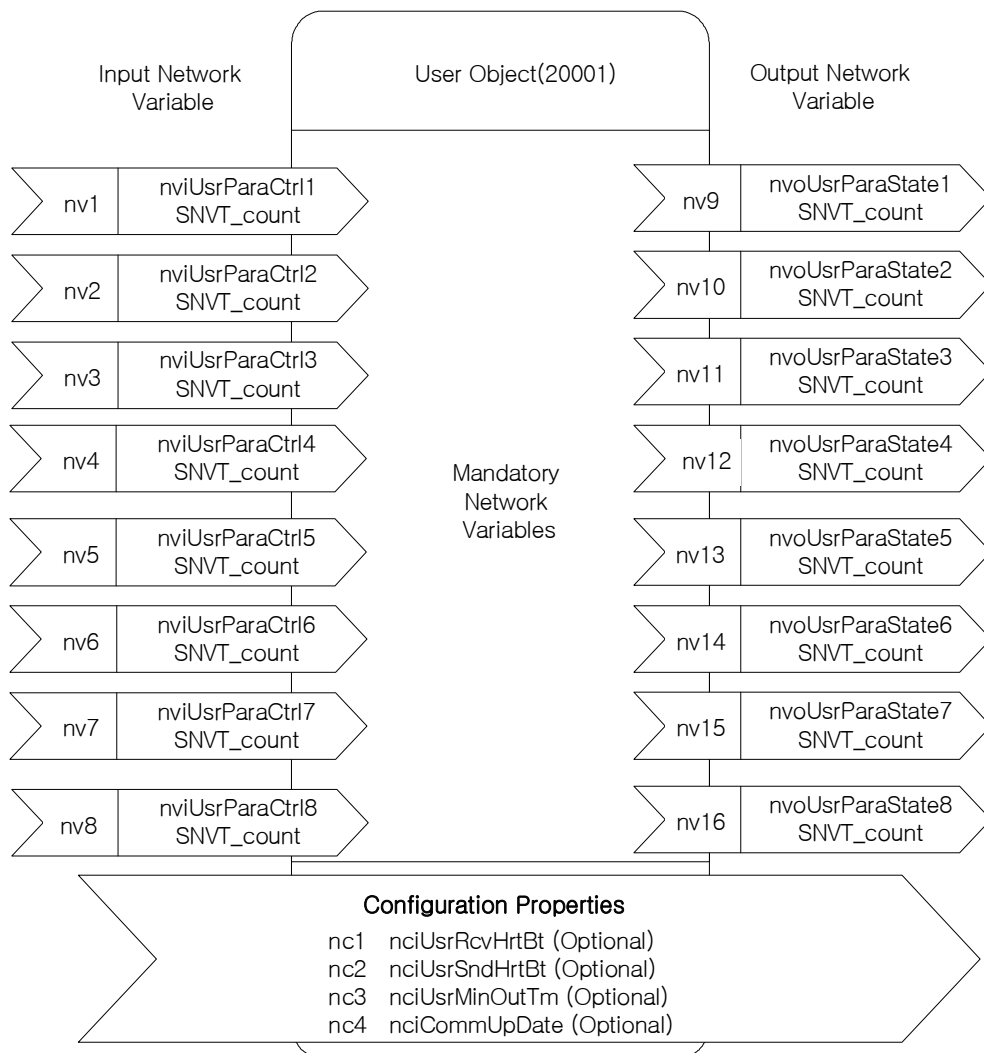$$③ \ \text{nciMaxSpeed} = \frac{\text{MaxFreq}}{\text{BaseFreq}} \times 100(\%) = \frac{68.52}{45.68} \times 100(\%) = 150.000\%$$

$$④ \ \text{nciMinSpeed} = \frac{\text{StartFreq}}{\text{BaseFreq}} \times 100(\%) = \frac{3.91}{45.68} \times 100(\%) = 8.555\%(8.559544...)$$

All the Base Freq used in the calculation uses nciNmlFreq to calculate.

The Max Freq value should not exceed 163.840% of the Base Freq. The maximum value of nciMaxSpeed is 163.840%.

## 8.3 User Object (User Function Profile Type)



| | | | | |
|---|---|---|---|---|
| | | **User Object(20001)** | | |
| Input Network Variable | | | Output Network Variable | |

nv1 — nviUsrParaCtrl1 SNVT_count

nv2 — nviUsrParaCtrl2 SNVT_count

nv3 — nviUsrParaCtrl3 SNVT_count

nv4 — nviUsrParaCtrl4 SNVT_count

nv5 — nviUsrParaCtrl5 SNVT_count

nv6 — nviUsrParaCtrl6 SNVT_count

nv7 — nviUsrParaCtrl7 SNVT_count

nv8 — nviUsrParaCtrl8 SNVT_count

Mandatory Network Variables

nv9 — nvoUsrParaState1 SNVT_count

nv10 — nvoUsrParaState2 SNVT_count

nv11 — nvoUsrParaState3 SNVT_count

nv12 — nvoUsrParaState4 SNVT_count

nv13 — nvoUsrParaState5 SNVT_count

nv14 — nvoUsrParaState6 SNVT_count

nv15 — nvoUsrParaState7 SNVT_count

nv16 — nvoUsrParaState8 SNVT_count

**Configuration Properties**

nc1   nciUsrRcvHrtBt (Optional)
nc2   nciUsrSndHrtBt (Optional)
nc3   nciUsrMinOutTm (Optional)
nc4   nciCommUpDate (Optional)

### 8.3.1 Network Input Variables

| Function | Variable | SNVT Type | Min. value | Max. value |
|---|---|---|---|---|
| User Parameter Control1 | nviUsrParaCtrl1 | SNVT_count | 0 | 65535 |
| User Parameter Control2 | nviUsrParaCtrl2 | SNVT_count | 0 | 65535 |
| User Parameter Control3 | nviUsrParaCtrl3 | SNVT_count | 0 | 65535 |
| User Parameter Control4 | nviUsrParaCtrl4 | SNVT_count | 0 | 65535 |
| User Parameter Control5 | nviUsrParaCtrl5 | SNVT_count | 0 | 65535 |
| User Parameter Control6 | nviUsrParaCtrl6 | SNVT_count | 0 | 65535 |
| User Parameter Control7 | nviUsrParaCtrl7 | SNVT_count | 0 | 65535 |
| User Parameter Control8 | nviUsrParaCtrl8 | SNVT_count | 0 | 65535 |

**(1) nviUsrParaCtrl1 ~ nviUsrParaCtrl8**

**▲ Definition**

Network input SNVT_count        nviUsrParaCtrl1 (identical until nviUsrParaCtrl8)

**▲ Description**

nvoUsrParaCtrl1 ~ nvoUsrParaCtrl8 are added network output variables to provide the LS inverter user with more flexible functions.

The strength of this function is the ability for the user to change the inverter parameter that the user actually wants to change and not the fixed parameter value of the inverter.

When the user puts in the address in parameter COM51~COM58 using the keypad, it corresponds one to one to the network variables, nviUsrParaCtrl1 ~ nviUsrParaCtrl8 and could change the set up parameter value.

For example, if the user sets COM51 as 0x0005 (Freq. setting), COM52 as 0x0006 (Operation command setting) and COM53 as 0x0007 (Accelerating time), the user could set the Frequency through nviUsrParaCtrl1, set the Operation command through nviUsrParaCtrl2 and change the Accelerating speed through nviUsrParaCtrl3. If you want to make the inverter run counterclockwise at a speed of 60.00Hz with an accelerating time of 10.0 sec., put in 6000 for nviUsrParaCtrl1, 0x0004 for nviUsrParaCtrl2 and 100 for nviUsrParaCtrl3.

▲ **Inverter parameters for nviUsrParaCtrl1 ~ nviUsrParaCtrl7**

| Code Number/<br>Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| COM-40 | User Parameter Control Number | 8 | 0~8 |
| COM-41 | User Parameter Control 1 | 0x0005 | 0~0xFFFF |
| COM-42 | User Parameter Control 2 | 0x0006 | 0~0xFFFF |
| COM-43 | User Parameter Control 3 | 0x0000 | 0~0xFFFF |
| COM-44 | User Parameter Control 4 | 0x0000 | 0~0xFFFF |
| COM-45 | User Parameter Control 5 | 0x0000 | 0~0xFFFF |
| COM-46 | User Parameter Control 6 | 0x0000 | 0~0xFFFF |
| COM-47 | User Parameter Control 7 | 0x0000 | 0~0xFFFF |
| COM-48 | User Parameter Control 8 | 0x0000 | 0~0xFFFF |

Cf.) When communicating with LONWORKS, the COM-40 User Parameter Control Number gets fixed to 8. Even if you change the value of COM-40 on the keypad, 8 will automatically reappear.

### 8.3.2 Network Output Variables

| Function | Variable | SNVT Type | Min. value | Max. value |
|---|---|---|---|---|
| User Parameter State1 | NvoUsrParaState1 | SNVT_count | 0 | 65535 |
| User Parameter State2 | nvoUsrParaState2 | SNVT_count | 0 | 65535 |
| User Parameter State3 | nvoUsrParaState3 | SNVT_count | 0 | 65535 |
| User Parameter State4 | nvoUsrParaState4 | SNVT_count | 0 | 65535 |
| User Parameter State5 | nvoUsrParaState5 | SNVT_count | 0 | 65535 |
| User Parameter State6 | nvoUsrParaState6 | SNVT_count | 0 | 65535 |
| User Parameter State7 | nvoUsrParaState7 | SNVT_count | 0 | 65535 |
| User Parameter State8 | nvoUsrParaState8 | SNVT_count | 0 | 65535 |

**(1) nviUsrParaState1 ~ nviUsrParaState8**

▲ **Definition**

Network output SNVT_count      NvoUsrParaState1 (identical until nvoUsrParaState8)

▲ **Description**

nvoUsrParaState1 ~ nvoUsrParaState8 are added network output variables to provide the LS inverter user with more flexible functions.

The strength of this function is the ability for the user to change the inverter parameter that the user actually wants to monitor and monitor the value of it. Not the fixed parameter value of the inverter.

When the user puts in the address in parameter COM31~COM38 using the keypad, it corresponds one to one to the network variables, nvoUsrParaState1 ~ nvoUsrParaState8 and the inverter's parameter value gets displayed.

For example, if the user sets COM31 as 0x000A (Output Freq.), COM32 as 0x000B (Inverter Output Voltage) and COM33 as 0x941E (Jog Freq.), the variable nvoUsrParaState1 will display the Output Freq. value, nvoUsrParaState2 will display the Inverter Output Voltage value and nvoUsrParaState3 will display the Jog Freq. value. If the inverter runs at a speed of 30.00Hz, the DC link voltage is 150.0V and if the Jog Freq. is set to 20.00, then would be the value for nviUsrParaState1, 3000, nviUsrParaState2, 1500 and nviUsrParaState3, 2000.

**▲ Inverter parameters for nviUsrParaState0 ~ nviUsrParaState7**

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| COM-30 | User Parameter State Number | 8 | 0~8 |
| COM-31 | User Parameter State 1 | 0x000A | 0~0xFFFF |
| COM-32 | User Parameter State 2 | 0x000E | 0~0xFFFF |
| COM-33 | User Parameter State 3 | 0x000F | 0~0xFFFF |
| COM-34 | User Parameter State 4 | 0x0000 | 0~0xFFFF |
| COM-35 | User Parameter State 5 | 0x0000 | 0~0xFFFF |
| COM-36 | User Parameter State 6 | 0x0000 | 0~0xFFFF |
| COM-37 | User Parameter State 7 | 0x0000 | 0~0xFFFF |
| COM-38 | User Parameter State 8 | 0x0000 | 0~0xFFFF |

Cf.) When communicating with LONWORKS, the COM-30 User Parameter State Number gets fixed to 8. Even if you change the value of COM-30 on the keypad, 8 will automatically reappear.

### 8.3.3 Network Configuration Variable

| Function | Variable | Optional/ Mandatory | SNVT Type |
|---|---|---|---|
| Receive Heartbeat Time for User Object | NciUsrRcvHrtBt | Optional | SCPTmaxRcvTime |
| Send Heartbeat Time for User Object | nciUsrSndHrtBt | Optional | SCPTmaxSndTime |
| Minimum Send Time for User Object | nciUsrMinOutTm | Optional | SCPTMinOutTime |
| Com-67 CommUpDate Function | nciCommUpdate | Optional | SCPTautoAnswer |

**(1) Receive Heart Beat Time for User Object (Mandatory)**

**▲ Definition**

Network config input SNVT_time_sec          nciUsrRcvHrtBt

**▲ Description**

Decide the maximum update cycle time of the User Object's network input variables, nviUsrParaCtrl1 ~ nviUsrParaCtrl8. If Update of nviUsrParaCtrl1 and nviUsrParaCtrl8 does not occur during the nciUsrRcvHrtBt time, it recognizes it as a communication command loss and starts to run as the mode set in COM Lost Cmd of IO-93.

If you want to use the communication command loss, you have to set the COM-02 Opt mode as a value, not "None." Furthermore, the IO-92 COM Lost Cmd mode has to be set as a value also.

Typical Range          0.0 ~ 120.0 sec (0.1 sec)

                          Invalid Data, when input value is 0xFFFF(6553.5 sec)

Default                 0.0 sec (not using Receive Heart Beat function)

**▲ Inverter parameters for nciRcvHrtBt**

| Code Number/ Common area address | Code Description | Default | Setting range |
|---|---|---|---|
| IO-92 | COM Lost Cmd | None | None |
| | | | FreeRun |
| | | | Stop |
| COM-02 | Opt mode | None | None |
| | | | Cmd |
| | | | Freq |
| | | | Cmd+Freq |

notice) When communicating with LONWORKS, communication loss time of the inverter, IO-93 COM Time Out value, does

| Input Network | User Object(20001) | Output Network |
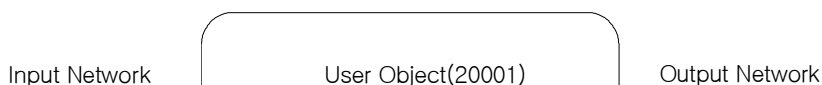
not get applied.

**(2) Send Heart Beat Time for User Object (Mandatory)**

**▲ Definition**

Network config input SNVT_time_sec        nciUsrSndHrtBt

**▲ Description**

It decides max. output time of the User Object network output variable, nvoUsrParaState1 ~ nvoUsrParaState8.

Typical Range        0.0 ~ 6553.4 sec

                     Value input, 0xFFFF (6553.5 sec) is invalid data.

Default              0.0 sec (It des not use the Send Heart Beat function)

**(3) Minimum Out Time for User Object (Mandatory)**

**▲ Definition**

Network config input SNVT_time_sec        nciUsrMinOUtTm

**▲ Description**

It decides the min. time that the User Object network variable, nvoUsrParaState1 ~ nvoUsrParaState8 has to wait until it gets sent through communication.

The network value does not change by every little variation but it sends out the changed value every nciMinOutTm time. It is used to reduce network traffic.

Typical Range        0.0 ~ 6553.4 sec (0.1 sec)

                     Value input, 0xFFFF (6553.5 sec) is invalid data.

Default              0.0 sec (It does not use the Minimum Out Time function)

**(4) COM-67 CommUpDate Function (Optional)**

**▲ Definition**

Network config input SNVT_boolean_t     nciCommUpDate

**▲ Description**

It means Keypad parameter, COM-67 CommUpdate Function. If input 1 in nciCommUpDate, it works as setting COM-67 CommUpDate YES.
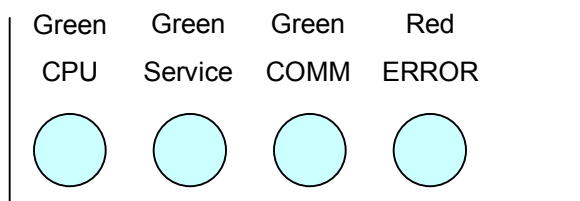
No works in nciCommUpDate except 1. If input 1, the Keypad parameters relate with Configuration Property are applied with Configuration Property variables and the nciCommUpDate is cleared as 0 automatically. (예 Acc Time, Dec Time, Base Freq, Start Freq, Max Freq, Pole Num)

Typical Range        0 ~ 255

Default              0

**9. LED Information**

There are 3 green LEDs and 1 red LED that indicate the present status of the iP5A LONWORKS Communication card and are lined up as follows on it.

Green    Green    Green    Red
CPU    Service    COMM    ERROR

| LED name | Color | Status |
|---|---|---|
| SERVICE | Green | **Off** – Indicates that the iP5A LONWORKS communication card is configured. **Blinking (0.5Hz)** – Indicates that the communication card is not configured. **On** – Indicates that the iP5A LONWORKS communication card has no application and that it is not configured. |
| CPU, ERROR | Green, Red | **CPU, ERROR blink at the same cycle –** Indicates error between LONWORKS communication card and iP5A. Able to check option error message through keypad. **CPU, ERROR blink in alternation –** Indicates that there is no problem in Can communication. . |
| COMM | Green | **Off** – Indicates that LONWORKS is not communicating. **Blinking** – Indicates that it is communicating. When the COMM LED is blinking, "light on" means that it is transmitting and "light off" means that it is receiving data. |