Concept 4000/5000
LAN Over Ethernet interface
P/N: 995093

INSTALLATION GUIDE

For <u>Revision B PCB</u> with <u>V1.10 Firmware or later</u>

<u>**IMPORTANT NOTES:**</u>

1)   **CONTROL MODULE FIRMWARE.**
   If LAN Over Ethernet interfaces are used, Control Module Firmware must be:
   C3000/4000: V7.40 Beta Build 05 or later.   C5000: V1.00 Build 02 or later.

2)   **INTELLIGENT 4-DOOR ACCESS MODULE FIRMWARE.**
   When connecting an Intelligent 4-Door Access Module (IFDAM) to a Concept LAN Over Ethernet (CLOE) interface:
   a) If the IFDAM Firmware (U3) is <u>V3.60 or later</u>, the CLOE Firmware must be V1.2 or later, and DIPswitch 1 (SET1) must be set to OFF.
   b) If the IFDAM Firmware (U3) is <u>prior to V3.60</u>, <u>and</u> the CLOE Firmware is V1.2 or later, DIPswitch 1 (SET1) must be set to ON.   (If CLOE firmware is prior to V1.2, the DIPswitch has no function and is set to OFF)
   c) If multiple IFDAMs are connected to a CLOE Slave, all the IFDAMs must be either V3.60 or later, or pre V3.60. You cannot mix V3.60 or later and pre V3.60 IFDAMs on the same CLOE Slave.
   d) It is permissable to have V3.60 or later IFDAMs on one CLOE Slave, and pre V3.60 IFDAMs on another CLOE Slave in the same system.
   e) It is also permissable to have V3.60 or later, and pre V3.60 IFDAMs connected directly to the Control Module LAN.

   CLOE firmware can be upgraded in the field with the CLOE Firmware Downloader software. *See p12.*

3)   **SYSTEM ARCHITECTURE.**
   a) A minimum of two LAN Over Ethernet interfaces are required for each installation.

   b) The following rules must be noted:
      i)   If more than 1 Master is required to be connected to the Control Module, the Master CLOE PCBs must be Revision B or later. (Look for "995093_B" in the corner nearest the DIPswitch)
      ii) If connecting more than 10 Concept Modules to a Slave causes the LAN A/B voltage to fall below 200mV, one or more additional Slave units will need to be installed.

   c) A CLOE Slave RS485 LAN <u>must not</u> be connected to other CLOE Slave RS485 LANs, or to a Master CLOE RS485 LAN.

4)   **LAN TERMINATION.**
   The CLOE is not addressed or treated as a Concept LAN Module by the Controller.
   However, since the CLOE connects to the Concept 4000/5000 RS485 LAN, it does possess a LAN Termination Link which must be configured correctly. *(See pages 3 and 4 for details)*

5)   **PROGRAMMING.**
   CLOE boards should be programmed prior to installation. <u>Please consult with the IT administrator and provide a copy of this manual prior to programming & installation.</u> *Details of the default programming and the configuration options for all CLOE boards is found on pages 6 to 9.*

OVERVIEW:

The Concept LAN Over Ethernet interface (CLOE) provides a secure, isolated connection of physically separate RS485 LAN segments over an Ethernet network.
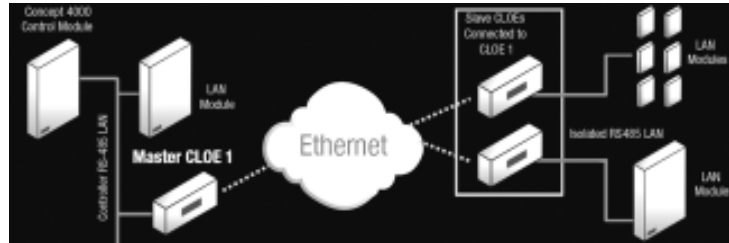
An interface consists of a Master and up to 4 Slaves. The CLOE boards are Installer configurable to be a Master or a Slave and employ 128-bit AES encryption for secure Ethernet communications.

A Master is connected directly to the Control module RS485 LAN, whilst up to 4 Slaves connect to the CLOE Master via Ethernet, each providing an isolated RS485 LAN segment. More Slaves can be supported by connecting additonal Masters to the Control Module.

The Master typically draws power from the Control module LAN connection. Each Slave must be provided with external power from a Module with a battery-backed power supply within their own LAN segment, or a separate battery-backed power supply.

The Master must use a static (fixed) IP address, while the Slaves would typically use DHCP IP address allocation, but may optionally use a static (fixed) IP address. Each CLOE board has a unique factory set MAC address.
LED indicators are provided to show: - Operational status (Run, Fault, Link status and Link speed).
                                              - RS485 LAN Data flow.
                                              - Ethernet Port data activity.

In providing the facility for LAN communications over Ethernet, the Concept LAN Over Ethernet also provides electrical isolation between the LAN segments thereby eliminating the potential for earth loops.

SPECIFICATIONS

Supply Voltage:	11 to 14V DC. (LAN or External Power Supply)
Current Consumption:	70mA
Installation environment:	0° to 40° Celsius
	15% to 85% Relative humidity (non-condensing)
CABLING.	
Ethernet Port:	As per standard 10/100MHz Ethernet cabling specifications.
Concept RS485 LAN port:	As per Concept 4000 LAN cabling specifications.
Physical dimensions:	PCB: 94 x 94 mm. Remember to allow for adequate space on the Ethernet connector side of the PCB for insertion/removal of the Ethernet cable when necessary.
Recommended Enclosures:	Mount in an existing Control Module, Universal Expander, IFDAM enclosure, etc. or a dedicated Inner Range enclosure:

990045WH   Off-white Plastic enclosure 238(L) x 118(W) x 74(D)mm
995200   Small Low Profile enclosure.
995200PE   Small Powered Low Profile enclosure.

PARTS LIST

-     Concept LAN Over Ethernet interface PCB assembly.
-     635093 Concept 4000/5000 LAN Over Ethernet interface Installation Guide (this document).
-     Installation accessory kit consisting of:
  -     4 x M3 x 10mm Pan head screws.
  -     4 x M3 PCB Mounting Clip.
  -     2 x 2 Way Plug on Screw Terminals.
  -     1 x 0.1" Jumper link.

Note: No Ethernet cables are supplied. Standard Ethernet cabling and connections are used.

INSTALLING THE LAN OVER ETHERNET INTERFACE PCB

1. It is recommended that the CLOE boards are programmed prior to being installed on the site. *See pages 6 to 8 for details.*

2. The Concept LAN Over Ethernet interface is supplied as a PCB kit which can be mounted using the range of fasteners provided in the accessory kit, in:
- An existing Concept product enclosure. (Space permitting)
- One of the Concept general purpose ancillary enclosures listed above.
- Another suitable Inner Range or 3rd party enclosure.

3. When choosing the location for mounting the PCB in an enclosure, ensure that adequate space is provided for insertion and removal of the Ethernet cable connector.

4. If cabinet tamper monitoring is required, a suitable tamper switch and end-of-line resistors must be fitted in the enclosure, then connected back to a spare zone input on a nearby Concept LAN Module. (The "Tamper" input on the CLOE board is <u>not</u> supported in the current Concept 3000/4000/5000 platform)

CONCEPT ETHERNET LAN DESIGN CONSIDERATIONS

The Concept LAN Over Ethernet interfaces can be used in a number of different configurations.
The flexible design allows:
- Multiple "Master" devices to be connected to the Control Module RS485 LAN port. **NOTE:** If multiple Masters need to be used, Revision B or later CLOE boards must be used. (Look for "995093_B" in the corner nearest the DIPswitch)
- Up to 4 "Slave" devices to be connected to each "Master" device via Ethernet.

RS485 LAN connection.
Connection of the Concept LAN Over Ethernet interface to the Concept 4000/5000 RS485 LAN is in accordance with normal LAN Module wiring rules and techniques.
See page 6 and the Concept 3000/Access 4000/5000 Control Module Installation Manual for more details.
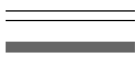
LAN Termination.
A Jumper Link (LK1 TERM) is provided to enable the LAN Termination to be configured correctly for the RS485 LAN segment that the CLOE is connected to.
When using Concept LAN Over Ethernet interfaces, each isolated segment of the RS485 LAN is treated as an independent RS485 LAN system for the purposes of determining where LAN termination is to be fitted.
Link LK1 "TERM" should be fitted:
 - When the CLOE interface is the first or last connection on a daisy-chained RS485 LAN segment.
 - When the CLOE interface is one of the two devices that are furthest apart on a star-configured RS485 LAN segment.

LAN Network examples.

Legend: ───────── Concept RS485 LAN.   **(M)** = CLOE Master.
        ━━━━━━ Ethernet.   **(S)** = CLOE Slave.

A basic connection uses 2 LAN Ethernet bridges to connect the Control Module RS485 LAN to one or more other Modules in a single remote location.

Up to 4 Slave units can be connected to the Ethernet network to connect the Control Module RS485 LAN to one or more other Modules in a number of remote locations.

LAN Over Ethernet interfaces <u>cannot</u> be used in a "daisy-chain" configuration.

THE LAN OVER ETHERNET INTERFACE PCB

P1. Port 0.
Temporary connection for programming and
commissioning via "Port 0 Cable" (P/N:993030).

ETHERNET PORT

L7. 100M
Off   10M Ethernet connection speed.
On   100M Ethernet connection speed.

L8. LINK
On   Ethernet connection present.
Flash Ethernet network activity.

P3. Ethernet Port

L10. ELAN TX/RX.
Flickering.   Indicates Ethernet traffic
Fast Flash.   Internal Fault. Return for service.
L9/L10 On. Master-Slave Ethernet comms lost.

L9. STATUS.
Slow Flash.   Device running OK
Fast Flash   Internal Fault. Return for service.

L13. 5V PWR.
On.   5V Power Supply OK.

S1. DIPswitch
1. REMOTE   NOT USED. Spare for future applications.
2. SET2   NOT USED. Spare for future applications.

CONCEPT RS485 LAN PORT

L11. CLAN RX. CLOE i/face is receiving data from the Concept RS485 LAN Port.
L12. CLAN TX. CLOE i/face is transmitting data to the Concept RS485 LAN Port.
L11/L12. Both On: Master-Slave Ethernet comms lost.

LK1 (TERM).
LAN Termination Jumper Link.
When using LAN Over Ethernet interfaces, each isolated segment of the RS485 LAN is treated as an
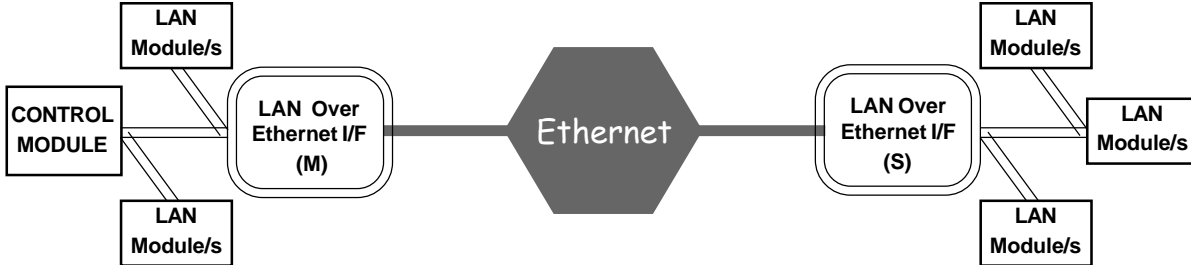independent LAN system for the purposes of determining where LAN termination is to be fitted.
Link LK1 should be fitted:
  -When the LAN Over Ethernet interface is the first or last connection on a daisy-chained RS485
  LAN segment.
  -When the LAN Over Ethernet interface is one of the two devices that are furthest apart on a star-
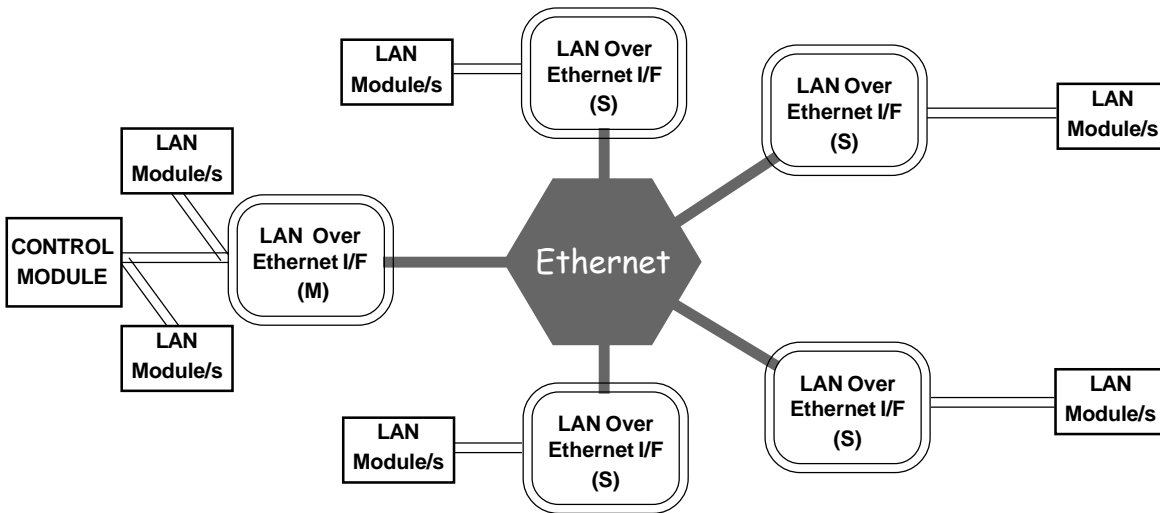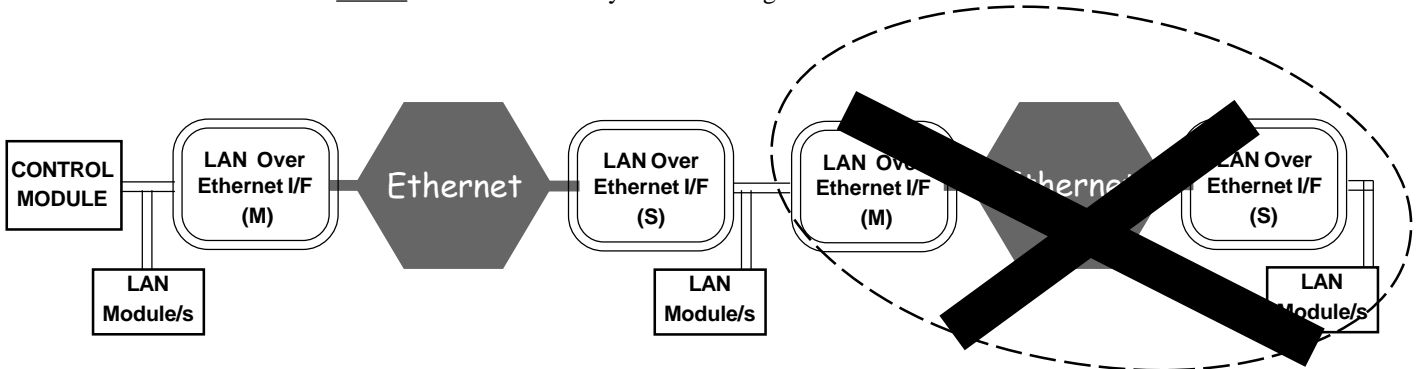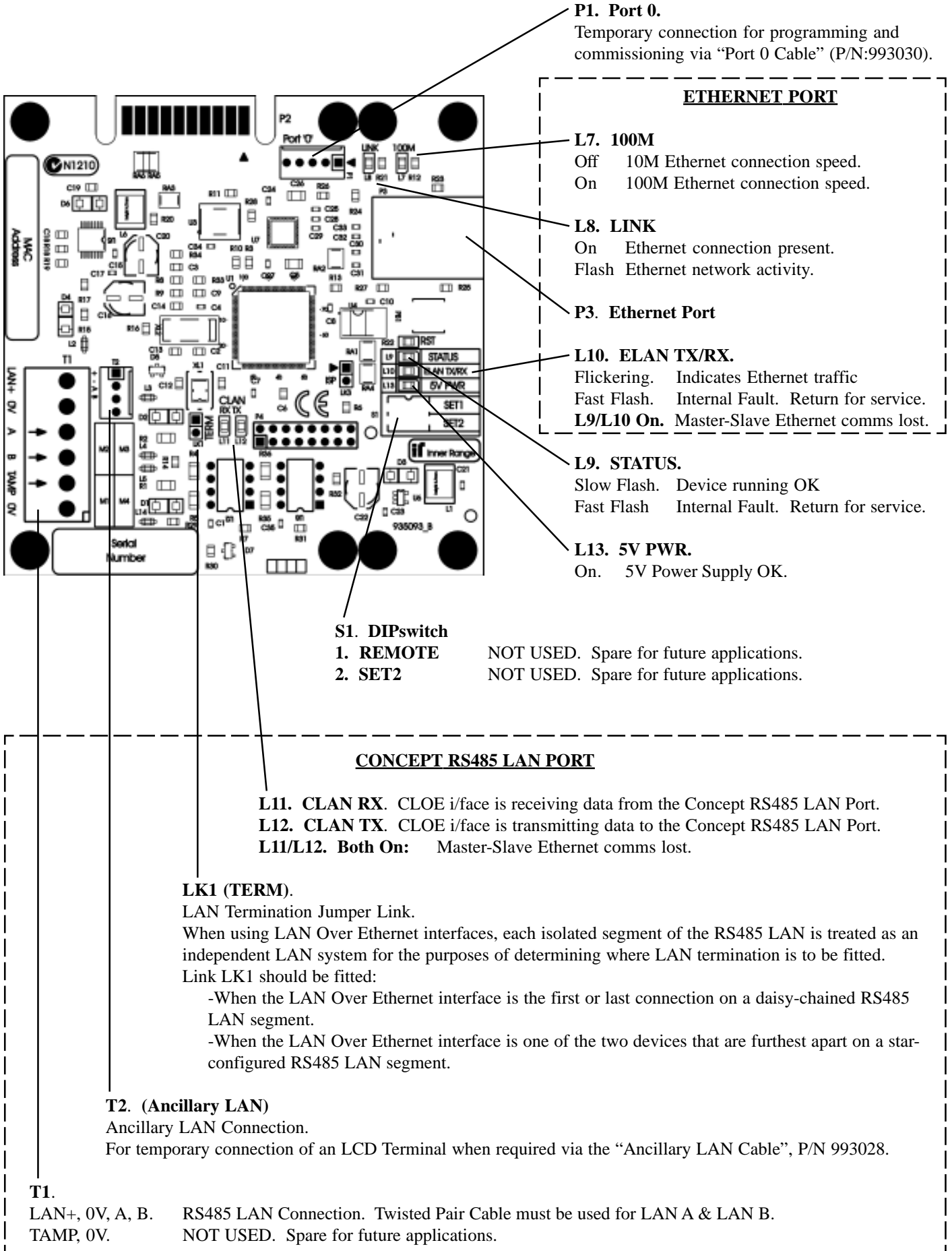 configured RS485 LAN segment.

T2. **(Ancillary LAN)**
Ancillary LAN Connection.
For temporary connection of an LCD Terminal when required via the "Ancillary LAN Cable", P/N 993028.

T1.
LAN+, 0V, A, B.   RS485 LAN Connection. Twisted Pair Cable must be used for LAN A & LAN B.
TAMP, 0V.   NOT USED. Spare for future applications.

POWER & LAN WIRING

LAN OVER ETHERNET INTERFACE POWERED FROM THE LAN

LAN+ 0V A B TAMP 0V

From Previous LAN module

To next module
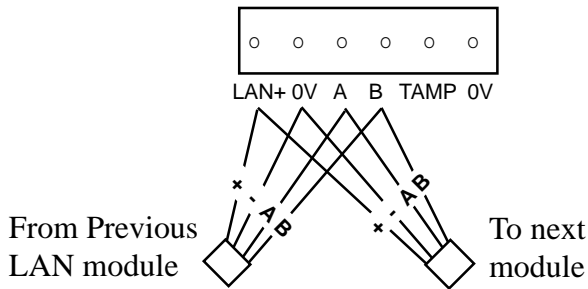
LAN OVER ETHERNET INTERFACE POWERED FROM EXTERNAL SUPPLY

LAN+ 0V A B TAMP 0V

Heavy duty Fig. 8 cable (24/0.20 or 14/0.20) recommended for Ext. Power Supply wiring.

✱ Note: If required, the LAN to subsequent Modules may derive +12V from "LAN +" or the incoming LAN cable.

EXTERNAL PWR SUPPLY (BATTERY BACKED)

+

-

- A B +

From previous LAN module

To next module
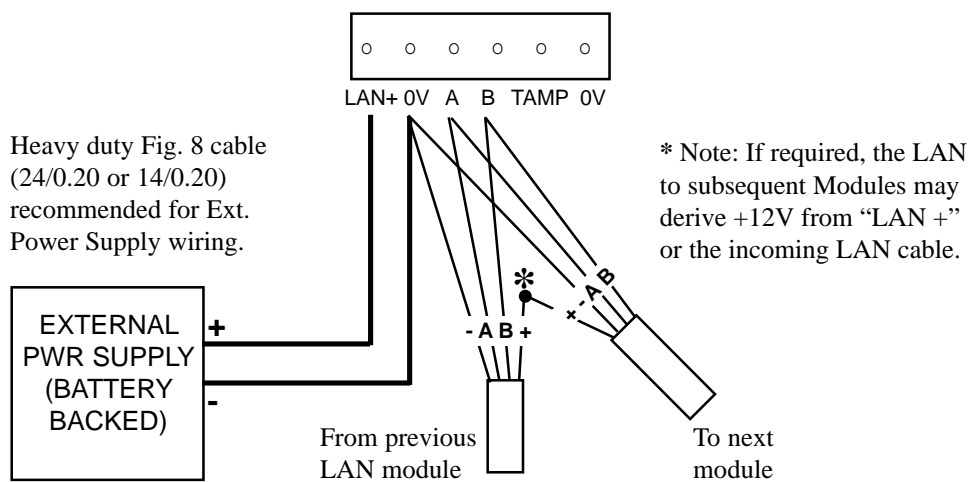
PROGRAMMING & COMMISSIONING

The Concept LAN Over Ethernet interface has an Installer console for configuration of each board.

This is accessed through a Terminal program on a Computer or Laptop, which is <u>temporarily</u> connected using a Port 0 cable (P/N 993030) to connector P1 (Port '0') on the CLOE board. The Computer Terminal program (e.g. Hyperterminal) must be configured to: - Baud Rate: 115200.   - 8 data bits and 1 Stop bit.
                        - No parity.   - Flow Control: None.

Ethernet network information. (Please ensure that the IT administrator is given this information)
The factory default programming for all CLOE boards is:
   - Slave mode, using DHCP   - Default Master address of 192.168.100.10
   - Subnet Mask of 255.255.255.0   - Gateway of 192.168.100.1

NOTE: If Port forwarding is required the IT administrator will need to know that the CLOE Slave connects via TCP to the Master on two IP ports, 9320 and 9321.

RECOMMENDED PROGRAMMING SEQUENCE:

1. Configure a Master:
   a. Set the Static (fixed) IP Address, Subnet Mask and Gateway assigned to this Master.
   b. Set the CLOE interface to be a Master.
   c. If the default encryption key value is to be changed, set a new encryption key.
   d. Perform a "Reset", the check the "Settings".

2. Configure one or more Slaves:
   a. Set each device to be a Slave using the nominated Master's Static (fixed) IP address.
   b. If a new encryption key was programmed for the Master, set the encryption key to the same value as set in the Master for all Slaves that will communicate with that Master.
   c. Perform a "Reset", the check the "Settings".

See the configuration examples on the following pages.

Console commands for configuring the CLOE interface Master and Slave, and diagnosing connection problems:

Command / Syntax	Used for:		Description
	Master	**Slave**	
fixedip n.n.n.n fixedip n.n.n.n s.s.s.s fixedip n.n.n.n s.s.s.s g.g.g.g	Y	O	Sets the IP address for the CLOE device to n.n.n.n. This is used for setting Master IP addresses and static Slave IP address. Optionally, the subnet mask s.s.s.s and gateway g.g.g.g may be set.
master	Y		Set a CLOE device to be a Master.
slave n.n.n.n		Y	Set a CLOE device to be a Slave, which connects to Master with IP address n.n.n.n.
dhcp		Y	Enables DHCP operation (Slave mode only)
device n	O	O	Sets a unique device ID number for the CLOE device. Optional setting. Not required when used with current Concept 3000/4000/5000 platform.
key n,n,n ...	O	O	Sets the encryption key. Sixteen hexadecimal numbers must be entered, each separated by a comma. Numbers in the range 0 to FF are allowed. e.g. key 4a,3e,9,c7,2,b6,48,39,e2,d,62,fa,5,7b,82,1f <ENTER>
reset	Y	Y	Reset CLOE board. This reads and applies configuration settings and must be performed after any settings are changed, except for the "key" setting. Alternatively, the board may be powered down & powered up again.
Diagnostic commands			
settings	Y	Y	Display the current configuration and IP Connections for a CLOE device.
myip	Y	Y	Current IP state. Displays additional IP information that may be useful to the IT administrator for troubleshooting Ethernet connection issues.
ping n.n.n.n	Y	Y	Ethernet connectivity test.
Notes:	Y = Yes. O = Optional.		
	All IP addresses are entered in the form n.n.n.n, where 'n' is a decimal number from 0 to 255.		

COMMISSIONING.

When the CLOE boards are programmed and installed in the system, the system may be powered up and tested as follows:

1) Check the CLOE interface status LEDs.   "5V PWR", "Status" and "ELAN TX/RX" LEDs are On.
    When P3 is connected to a switch/router/hub: "LINK" is On or flickering, "Status" is slow flashing and
                                                        "ELAN TX/RX" is flickering.
    When T1 is connected to the Concept RS485 LAN: "CLAN RX & TX" flash occasionally.

2) Perform a "LAN Secure" operation (MENU, 7, 8, 1).

3) Check Review. All Concept Modules that are installed in the system and are currently operational should have a "Module Found" event logged to Review immediately following the "LAN Secured" event.

    Any "Module Found" or "Module Recovered" Review event for Modules that are connected via Ethernet will be preceded by an additional Review event that identifies the associated CLOE Master-Slave pair.
    i.e. CLEB Module: MAC = mmmm-ssss   Where: mmmm is the last 4 digits of the CLOE Master's MAC address.
                                                              ssss is the last 4 digits of the CLOE Slave's MAC address.

    The status of individual Modules can also be checked from an LCD Terminal in the Module Programming Menu.
    Select the Module Type to inspect (MENU, 7, 2, x), then press the ON key. The current status of the Module is displayed.
    - If the symbol after the "Present" status message is an arrow ($\rightarrow$) or a carriage return ($\hookleftarrow$), the Module is communicating via Ethernet.
    - If the symbol is a dash (-), the Module is connected directly to the Control Module LAN.
    The status of other Modules of the same type can be viewed by using the DOWN and UP arrow keys.

See page 11 for a troubleshooting guide and more information on these operations.

CONFIGURATION EXAMPLES

The CLOE interface console will display a command prompt: **>**.
User input at the Console in the examples is shown in *italics*.

Master

```
Concept LAN over Ethernet Serial Console
Firmware V1.10
>
0000000050              Removing All Modules
0000000051              Ethernet Encryption Enabled


>fixedip 192.168.1.97 255.255.255.0 192.168.1.0
IP address changed to 192.167.1.97
Sub-net mask set to 255.255.255.0
Gateway set to 192.168.1.0


>master
MASTER/LOCAL mode enabled.
Fixed IP address 192.167.1.97 will be used.


>reset
Concept LAN over Ethernet Serial Console
Firmware V1.10
>
0000000050              Removing All Modules
0000000051              Ethernet Encryption Enabled


>settings

CLOE Status and Configuration.
 Unit is a Master, device number 6.
 IP assignment is fixed (192.167.1.97).
 Ethernet is not yet available.
 Slave connections:
```

Slave – using DHCP

```
Concept LAN over Ethernet Serial Console
Firmware V1.10
>
0000000050              Removing All Modules
0000000051              Ethernet Encryption Enabled


>slave 192.168.1.97
SLAVE/REMOTE mode enabled.
Master is at IP address 192.168.1.97


>dhcp
Slave DHCP mode enabled.


>reset
Concept LAN over Ethernet Serial Console
Firmware V1.10
>
0000000050              Removing All Modules
0000000051              Ethernet Encryption Enabled


>settings


CLOE Status and Configuration.
 Unit is a Slave, device number 11.
 IP assignment is by DHCP.
 Ethernet is not yet available.
 Master address is 192.168.1.97
```

Slave – using fixed (static) IP address

```
Concept LAN over Ethernet Serial Console
Firmware V1.10
>
0000000050              Removing All Modules
0000000051              Ethernet Encryption Enabled


>slave 192.168.1.97
SLAVE/REMOTE mode enabled.
Master is at IP address 192.168.1.97


>fixedip 192.168.1.90 255.255.255.0 192.168.1.0
IP address changed to 192.168.1.90
Sub-net mask set to 255.255.255.0
Gateway set to 192.168.1.0


>reset
Concept LAN over Ethernet Serial Console
Firmware V1.10
>
0000000050              Removing All Modules
0000000051              Ethernet Encryption Enabled


>settings


CLOE Status and Configuration.
 Unit is a Slave, device number 11.
 IP assignment is fixed (192.168.1.90).
 Ethernet is not yet available.
 Master address is 192.168.1.97
```

TROUBLESHOOTING & DIAGNOSTICS

The Terminal program "settings", "myip" and "help" commands can be used on a CLOE interface board while it is operating to obtain status, diagnostic and help information. The "settings" and "help" commands can be used at any time. The "myip" command is used when network communications is established.
Note: The Port 0 connection is for a temporary connection only. Ensure that the Port 0 cable is disconnected when not in use.

Typical "settings" information from a Master unit.

```
CLEB Status and Configuration.
 Unit is a Master, device number 32.
 IP assignment is fixed (192.168.1.34).

 IP address is 192.168.1.34. Ethernet is OK.
 Slave connections:
   IP 192.168.1.103, Data and Command OK.
```

Typical "settings" information from a Slave unit.

```
CLEB Status and Configuration.
 Unit is a Slave, device number 33.
 IP assignment is by DHCP.

 IP address is 192.168.1.103. Ethernet is OK.
 Master address is 192.168.1.34
 Connected to IP 192.168.1.34, Data and Command OK.
```

Typical "myip" information.
Master unit.

```
>myip
Interface 'en0':
 MAC address: 00:11:B9:04:00:20
 IP address   192.168.1.34
 Sub-net mask 255.255.255.0
 Gateway      192.168.0.1
 Link is UP.
 I/F is UP.
 Fixed-IP mode.
 Unit is a Master.
```

Slave unit.

```
>myip
Interface 'en0':
 MAC address: 00:11:B9:04:00:21
 IP address   192.168.1.103
 Sub-net mask 255.255.255.0
 Gateway      192.168.1.1
 Link is UP.
 I/F is UP.
 DHCP mode.
 Unit is a Slave.
 Master address is 192.168.1.34
```

The "help" information from a CLOE unit.

```
>help
Concept LAN Ethernet Bridge
RS232 Configuration Console
Available commands (not case sensitive):

DEVICE number : Assigns a device number to this unit.  Must be unique.
DHCP          : Enables DHCP mode (slave mode only).
FIXEDIP ip_addr [subnet [gateway]]: Enables fixed IP mode and sets IP address.
MASTER        : Sets this unit to be a Master (on controller LAN).
MYIP          : Displays current IP state of this unit.
PING ip_addr  : Ethernet IP connectivity test.
RESET         : Reboot this device.  Reboot device after changing any settings.
SETTINGS      : Displays a summary of all current configuration and status.
SLAVE ip_add  : Sets this unit to be Slave, to Master at 'ip_address'.
KEY n1,n2...n16 : Sets ethernet encryption key. 16 byte values in hex format.


All IP addresses are entered in the form n.n.n.n, where n is decimal 0-255.
```

If problems are encountered, perform the following checks.

Check	Result	Description / Action
"5V PWR" LED is On	Yes	OK
	No	Check for correct power supply voltage and wiring.
"STATUS" LED	Fast Flash	Internal Fault. Return for service.
	On	Unit OK, but no Ethernet activity.
	Slow Flash	OK
ELAN LED	Fast Flash	Internal Fault. Return for service.
	On	Slave and Master are unable to connect. Check for valid setting for Master's IP address, DHCP mode and link status – use 'settings' &/or 'myip' commands. Contact your IT administrator for setting Slave subnet mask and gateway for your network if required.
	Flickering	OK
"Link" LED is On or Flickering	Yes	Ethernet connection OK
	No	Check Ethernet connections to hub/router/switch.

If the Slave connects to its Master but Modules do not address, check:
 - Control module firmware is V7.40 build 05 or later.
 - For correct LAN termination on all Concept RS485 LAN segments connected to a CLOE Master or a CLOE Slave.
 - Encryption keys on the Master and it's associated Slaves are the same.

To check the status of individual Modules via an LCD Terminal, select the Module Type to inspect (MENU, 7, 2, x), then press the ON key. The current status of the Module is displayed. e.g.   `R01 Present-000   or   R01 Absent`
`and secure`
The status may be; "Absent", "Present but not secure", or "Present and secure", depending on the LAN security status.
If Present and the symbol after the "Present" message is an arrow ($\rightarrow$) or a carriage return ($\downarrow$), the Module is communicating via Ethernet. If the symbol is a dash (-), the Module is connected to the Control Module LAN.
The 3-digit number in the message indicates the number of times the module has failed to acknowledge a poll from the Control Module since the last LAN Init. or LAN Secure operation and provides an indication of LAN reliability.

Error messages.

During programming of a CLOE unit, the Serial Console may also provide error messages to alert the programmer to any programming problems.
e.g.   >fixedip 192.168.1.34
        IP address changed to 192.168.1.34
        ERROR: IP and Gateway are on different subnets!

FIRMWARE UPGRADES

The CLOE interface unit's firmware is field upgradeable using the CLOE Downloader utility software.
The utility software and upgrade firmware files are available from the Inner Range Technical Support Website.
http://www.innerrange.com/Restricted/Support/Supphome.cfm

Disclaimer:
While every effort has been made to ensure the accuracy of this manual, the manufacturer assumes no responsibility or liability for any errors or omissions. Due to ongoing development, this manual is subject to change without notice.

Designed & manufactured in Australia.