

# **Analyser Control Unit Mk4**

## **Operating Manual**



## **Kittiwake Procal Limited**

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Kittiwake Procal Limited  
5 Maxwell Road  
Woodston  
PETERBOROUGH PE2 7HU  
United Kingdom

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# 1 Introduction

## About this manual

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This manual is intended to assist the user in the safe and efficient installation, operation and maintenance of the PULSI Analyser series of process gas analysers. It has been written in accordance with the requirements of British Standard BS4884 *Technical manuals* Part 1: 1992.

It is split into a number of sections. *Introduction* (this section) gives a brief overview of both this manual and the systems which it describes, together with sources of further information and product support. *Installation* gives pre-installation information and goes on to describe how the Control Unit of a PULSI Analyser system is installed.

## About the PULSI Analyser series

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The PULSI Analyser series is a range of high-performance gas process analyser systems. These systems are intended to be used for measuring gas concentrations, particularly in continuous industrial processes and flue stacks.

Every system includes up to four PULSI Analysers and a PROCAL Analyser Control Unit.

This technical manual describes primarily the Analyser Control Unit. A separate manual exists for

Each type of Analyser, eg P200.

Software loaded on the Analyser Control Unit (ACWn) 7- 3038

## About the Procal 5000 Analyser.

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The description and operation of the Procal 5000 Analyser is to be found in its own manual, part number 7-3512-00. For connection of the P5000 to an ACU, with and without other Analyser Units, refer to the installation drawing number 7-4951-11.

## Repair Policy

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Kittiwake Procal recommends that repairs to the PULSI Analyser system or Procal 5000 system are only made by its own trained support staff, or by those of its distributors world-wide.

If you have the necessary technical qualifications, training and experience you may wish to make straightforward repairs in-house. A spares list is given for this purpose. However, you should note that if a repair is incorrectly carried out, this may void or limit the warranty on the system. You should also note that this manual is *not* intended to describe fault-finding or repair down to component level.

## Documentation Conventions

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### Abbreviations

Within this manual, the following abbreviations are used:

■	ACU	Analyser Control Unit
■	ACWn	Analyser Control for Windows Network – Software
■	AVU	Auto Verification Unit
■	IR	Infra red
■	ISH	In-Situ Heater
■	AU	Analyser Unit
■	PSU	Power Supply Unit
■	UV	Ultra violet

### Lists

Often in this manual, instructions or information are presented in list form. Use of black squares ■■■ indicates that there is no special order to the instructions or information. However, when instructions are numbered, it is important that the individual instructions or points are followed sequentially.

### Figures

Figures in the text are always numbered in the form *Figure X-Y*, where *X* is the section number, and *Y* is the sequential figure number within that section. For example, *Figure 3-2* is the second figure in section 3. When a figure reference is in brackets (*Figure 9-4*), this refers you to that figure, usually to confirm the location of a component, control or indicator.

### Italics

*Paragraphs in italics usually indicate background information which may be of benefit to the reader. Groups of words in italics are usually cross-referring the reader to a section or sub-section by name.*

### Dimensions

All dimensions in this *Operating Manual* are in mm (millimetres) unless otherwise indicated.

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## PULSI Analyser system - an overview

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At each Analyser, the concentrations of up to six gases may be measured. In addition, up to three analogue inputs can be accepted as 0 - 20 mA, 4 - 20 mA, 0 - 5 V or 1 - 5 V signals

A schematic diagram of a typical PULSI Analyser system appears in Figure 1-1. This shows the various interconnections between different parts of the system, and some of the external devices that may be connected to the Analyser Control Unit.

Each Analyser functions independently but each is controlled by the Analyser Control Unit, which collects data from all of the Analysers. The Analyser Control Unit displays and stores readings obtained from the Analysers.

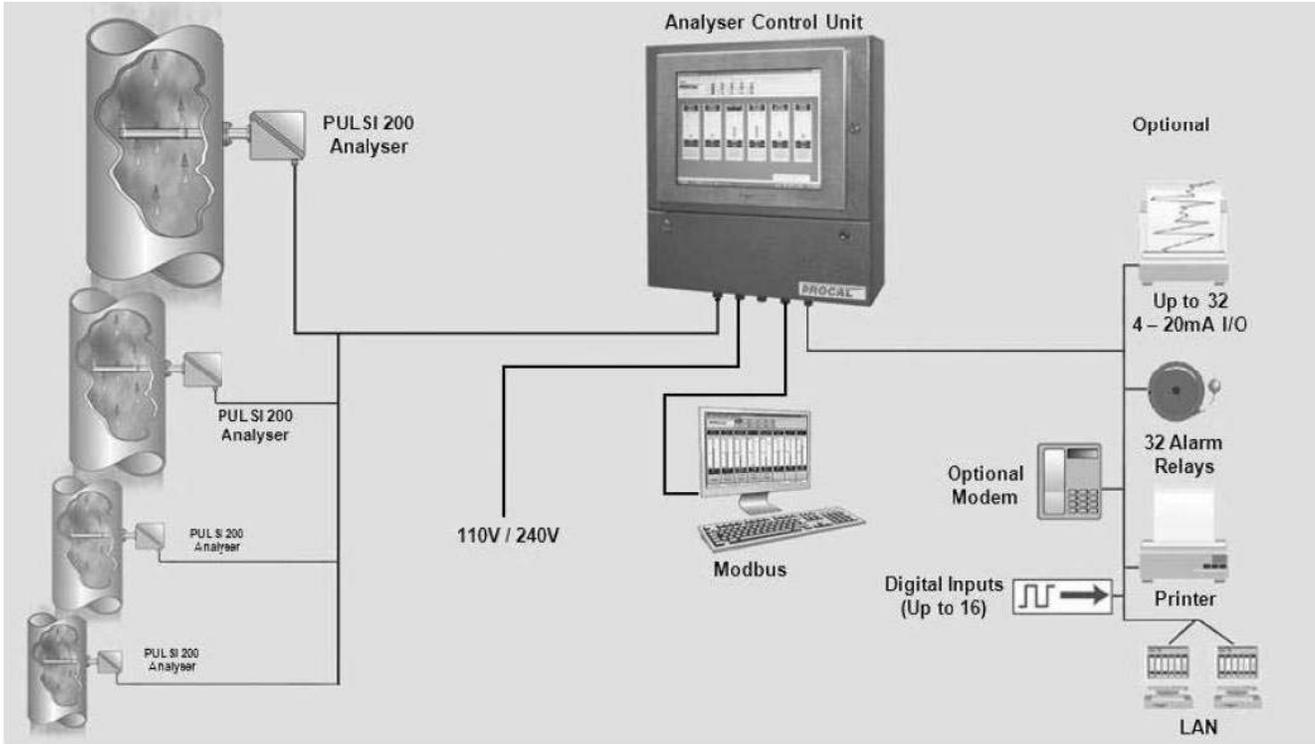


Figure 1-1 PULSI Analyser system schematic

## Further information

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This *Operating Manual* aims to provide all the information you require to install, operate and dispose of your PULSI Analyser system. If you require any further information regarding the system or its use, you should contact Kittiwake Procal Ltd., or your Procal distributor as shown in the panel below:

<p>Kittiwake Procal Limited 5 Maxwell Road Woodston PETERBOROUGH PE2 7HU United Kingdom</p> <p>tel: +44 1733 232495 (international) (01733) 232495 (within the UK)</p> <p>fax: +44 1733 235255 (international) (01733) 235255 (within the UK)</p>
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# 2 Technical Specification

## Introduction

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The ACU is a computer-based system, which processes the information collected by PULSI Analysers. It is designed for both control room and external environments. Connection to the Analyser Unit(s) is by means of a 4core cable (two twisted pair).

## ACU specification

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Functions	Processing of raw data from Analyser Units to produce concentration readings in the customer-specified units.  Optional: Analogue I/O in the form of up to thirty two 0 - 20 mA or 4 - 20 mA signals.  Volt-free switching in the form of thirty two relays.  Each of the thirty two current transmitters and thirty two relays can be assigned to any analyser and any channel.
Information display	Touch Screen
Display parameters	See Analyser Control for Windows Network ACWn
Communications	RS232 or RS485 serial interface.  Lan – Ethernet two ports 10/100/1000Mbps
Controls	Touch Screen Optional Keyboard and pointing device
<b>Optional</b>	
Controls	Keyboard and pointing device
Outputs	Up to 32 current outputs 0 - 20 mA or 4 - 20 mA, each galvanically isolated from ground and from each other. Normally only fitted with the same number as the number of displayed channels.  Power 24V 0.8A available TS6-5+24V and TS6-6 0V
Printer Port	USB Parallel printer interface
Inputs	Up to 32 current, voltage or contact inputs, each galvanically isolated from ground and from each other. Not normally fitted.

Outputs (continued)	Thirty two (32) volt-free relay outputs, (n/c or n/o selectable) for channel low/high alarms and various other functions
Data storage	Internal Hard Drive minimum 18 months data logging of all monitored concentrations and calibration logs.
Software (Loaded)	Analyser Control for Windows network (ACWn)
Power down protection	Battery-backed memory of all configuration parameters, and user adjustments. Storage time with analyser unpowered: three months.
Enclosure	<p>Polyester powder coated mild steel, Stainless Steel panel PC bezel, sealed to IP65 NEMA 4X.</p> <p>Cable entry by through blank gland plate can accommodate up to 9 M20 glands Note the gland plate is supplied blank to enable the customer to determine gland configuration dependent on interface requirements and local wiring codes.</p>
Operating environment	<p>Operating temperature range: -10°C to +45°C. (14°F to +113°F)</p> <p>Non-hazardous area rating.</p>
Services required	90 - 264 V ac; 47 to 63 Hz at up to 70 W Typical / 160W Maximum (depending on number of OHUs fitted).
Weight	23kg (50 lb)
Maximum dimensions	510mm(H) x 480mm(W) x 184mm(D) 20"(H) x 19"(W) x 7.2"(D)

## **ACU to Analyser interconnection cable lengths**

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### **Local PSU for Analyser**

To power each PULSI Analyser a local Power Supply Unit (PSU) is required. The nominal supply requirement for each PULSI Analyser is 24V dc at 3.5A which includes the continuous power required by the Autozero solenoid.

The PSU should be located as close to the Analyser as possible, the voltage at the analyser terminals should be not less than 22V.

Note that the P5000 analyser is mains operated.

### **ACU to Analyser Cable (Communication)**

The recommended Belden data cables have an individual screen for each twisted-pair and the drain wire for each should be connected to 0V dc at the ACU. Experience has shown that in almost all cases there is no reduction in system performance or reliability if the screen drain wire is also connected to 0V dc at each Analyser.

Unless otherwise stated, Belden 9842 data cable is assumed which has 18 AWG individual conductors the Analyser can be up to 1200M (4000') from the ACU. Its characteristic impedance is approximately 50ohms whilst the recommended data line termination resistance for RS485 is 120ohms. Given the short cable distances used (< 300M) and the slow data rate (< 20K bits/sec) there will be no noticeable data pulse distortion. It is possible to use smaller cable such as Belden 9502 (24 AWG) where only short distances are required.

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# 3 Installation

## Introduction

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This section describes how to install the ACU. Installation procedures for Analysers and other associated equipment are detailed in the technical manuals for those components.

### **WARNINGS**

YOU MUST NOT ATTEMPT TO INSTALL THIS SYSTEM UNLESS YOU ARE QUALIFIED, COMPETENT AND AUTHORIZED TO WORK ON ELECTRICAL EQUIPMENT OPERATING AT YOUR LOCAL MAINS ELECTRICAL SUPPLY VOLTAGE.

READ THIS SECTION IN ITS ENTIRETY BEFORE ATTEMPTING TO INSTALL ANY PART OF THE SYSTEM. IF THERE IS ANYTHING YOU DO NOT UNDERSTAND, OR YOU DO NOT FEEL CONFIDENT OF YOUR ABILITY TO FOLLOW THE INSTALLATION INSTRUCTIONS, DO NOT PROCEED. CONTACT KITTIWAKE PROCAL OR YOUR PROCAL-AUTHORISED DISTRIBUTOR.

## Unpacking the system components

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If this has not already been done, unpack the system components and check that they correspond to the units ordered and listed on the accompanying packing note. If there is any discrepancy, or any damage is apparent, do not attempt to install the system. Contact Kittiwake Procal, or your Procal distributor.

## Fitting and preparing the ACU

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The ACU is designed to be wall mounted in the control room, shelter or other designated location. The wall mounting bracket is supplied with the ACU.

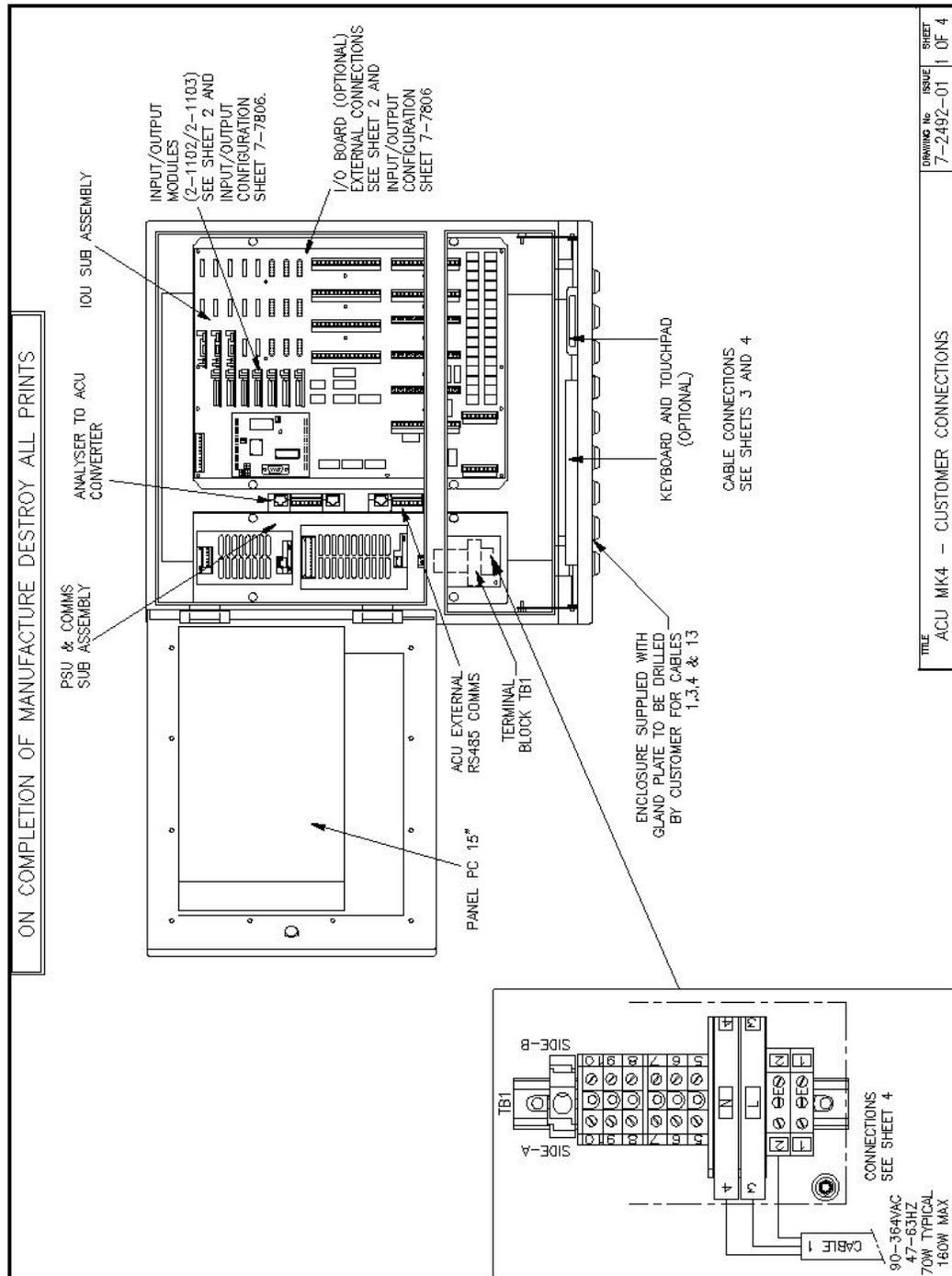
### **WARNING**

DO NOT CONNECT THE MAINS CABLE (POWER CORD) TO THE ELECTRICAL SUPPLY UNTIL ALL CONNECTIONS WITHIN THE ACU HAVE BEEN MADE. FAILURE TO FOLLOW THIS WARNING MAY RESULT IN SERIOUS OR FATAL INJURY FROM ELECTRIC SHOCK.

## Gaining internal access to the ACU

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Unlock both the main hinged door and keyboard / pointing device access hinged door using the key provided. A view of the terminals and main components is shown in Figure 3-1



DRAWING No. ISSUE SHEET  
7-2492-01 1 OF 4

TITLE  
ACU MK4 - CUSTOMER CONNECTIONS

Figure 3.1 Main ACU components

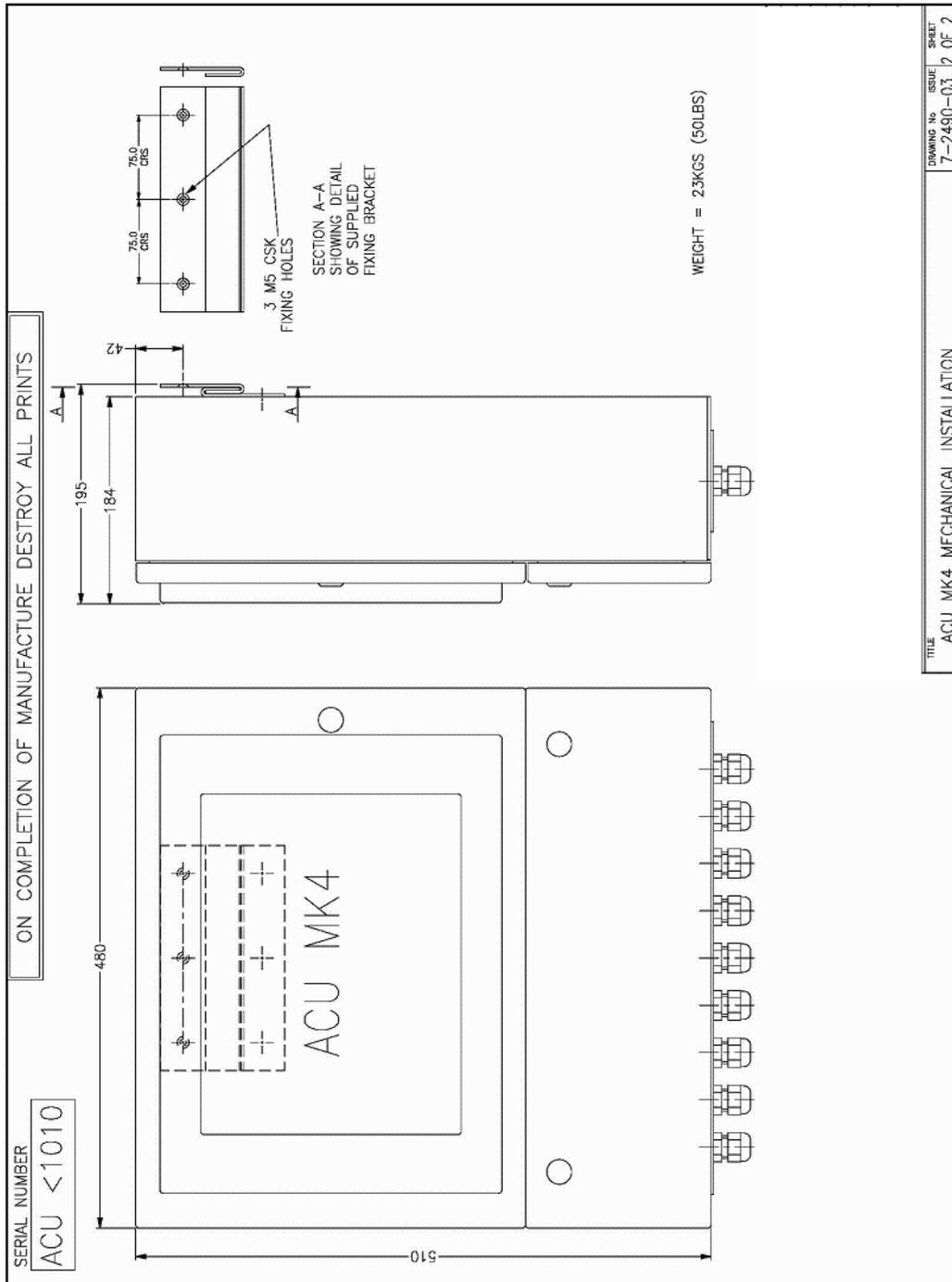


Figure 3.2 Mounting details for the ACU  
*Cables will need to be fed in through glands mounted in the base of the ACU. Note the gland plate is supplied blank (undrilled)*

## Preparing cables for the ACU

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During preparation of the ACU, you may need to refer to the relevant installation drawing in the *Order-specific information* section of this manual, particularly if you will be making up your own interconnecting cables.

The cables used to connect other system components to the ACU are shown in Figure 3-4.

Specifications for the cables are as follows:

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Data cable to Analyser	2 twisted pairs, impedance 50 - 120 ohms, size 18 AWG. Suitable cable is Belden 9842, wire ends for screw terminal connection. Functions are: RS485 transmit, RS485 receive.
Mains supply cable	3 core cable, rated for the local supply, 0.5 mm <sup>2</sup> cross section min, wire ends for screw terminal connection.
Customer connections to relays and 4 - 20 mA outputs	unscreened circular cross-section cable with the required number of cores, outside diameter 15 mm max. Note that while both the relays and the current outputs are galvanically isolated from ground, the voltage superimposed on them should not exceed 50 V dc.
Optional RS485 data cable	screened circular cross-section cable, 2 twisted pairs, of outside diameter 15 mm max, Beldon 9302 is suitable. Wire ended for screw terminal connection.

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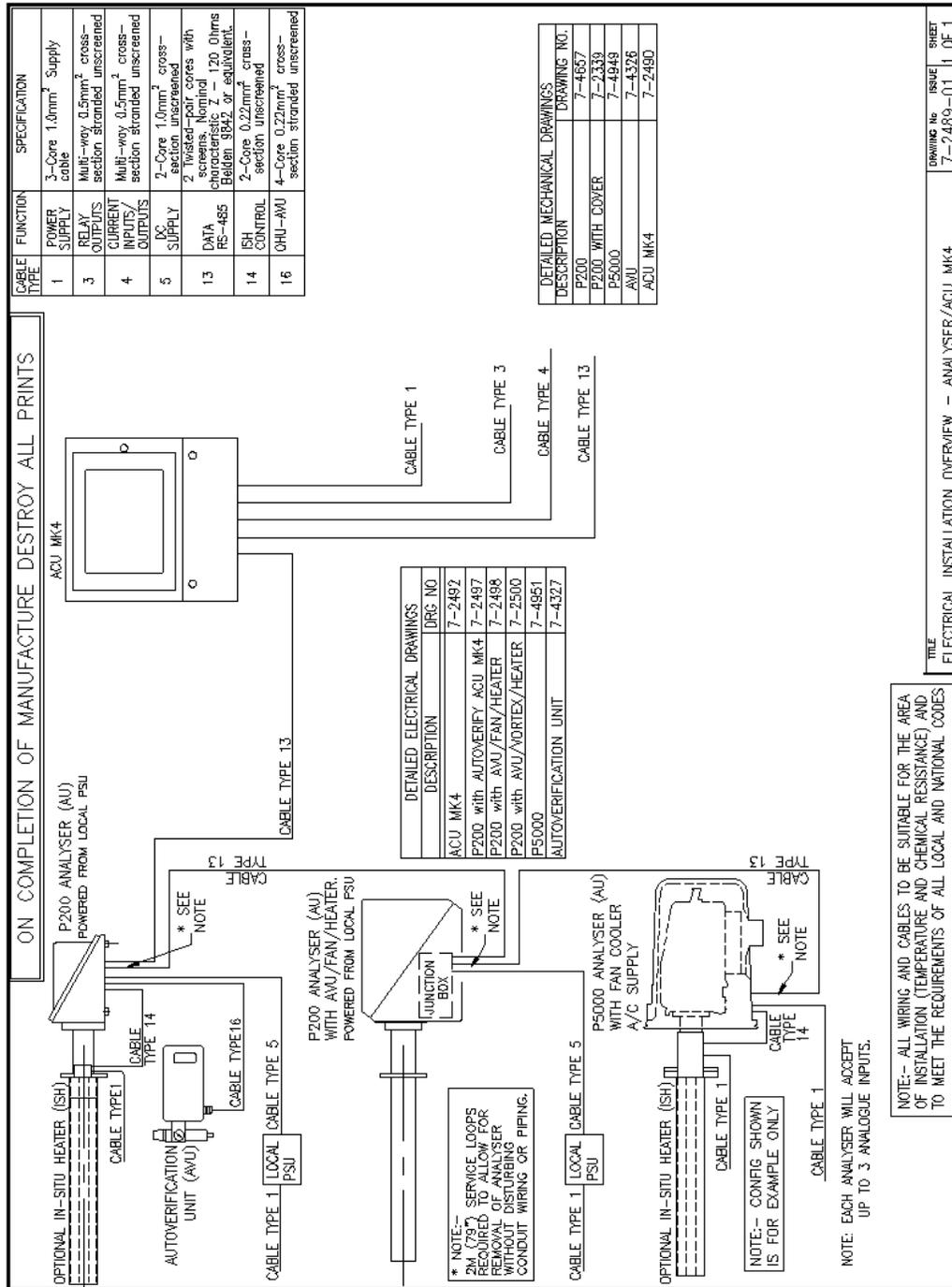


Figure 3.3 Analyser system interconnections from 7-2489-01

## Feeding cables into the ACU

The gland plate mounted in the bottom of the ACU enclosure must be removed before gland holes are drilled, Before drilling it is important to determine the number of glands required. The gland for the power cable / lead should be located on the left hand side of the gland plate to line up with terminal block 1.



Connect the cables to the ACU as follows:

Data cable (ACU – Analyser)	See 7-2492 Analyser to ACU Converter
Mains supply cable	Wire to Terminal Block TB1.
Connections to relay	Connect to terminal TS2, TS4, TS8 or TS10 as shown in Figure 3.5. 4 - 20 mA outputs or inputs. Connect to terminal TS1, TS3, TS7 or TS9 as shown in Figure 3.5.
Printer	Connected to the USB connector on the base of the panel PC.
Network	Connected to the Network connection connector on the base of the panel PC.
External Comms (ACU – DCS)	See 7-2492 External RS485 Comms Converter

## Connecting the system to the electrical supply

1. Ensure that a 2.5 A, 20 mm slow blow fuse is fitted in both terminal mounted fuses (located on TB1, see Figure 3-4).

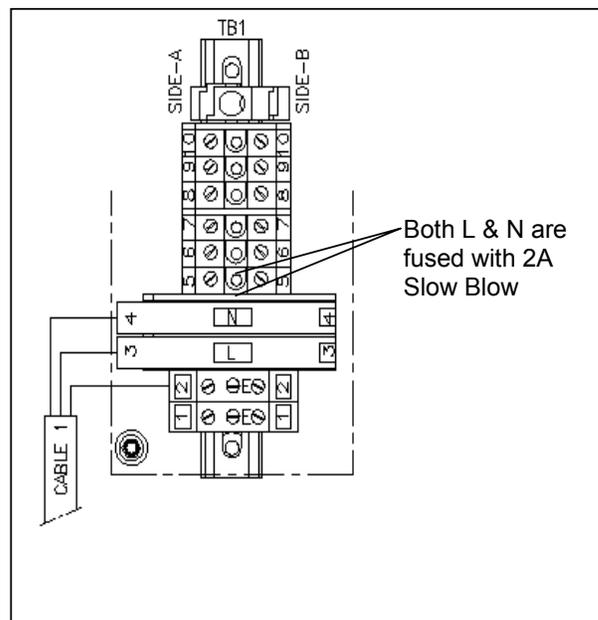


Figure 3.4 ACU mains connector and fuse location

(Extract from Drawing 7-2492-01 sheet 1 of 4)

2. Connect mains Cable / Lead to TB1 –
  - Live TB1- 3
  - Neutral TB1-4
  - Earth TB1-2 (Earth must be connected)

### Connecting to Analyser(s)

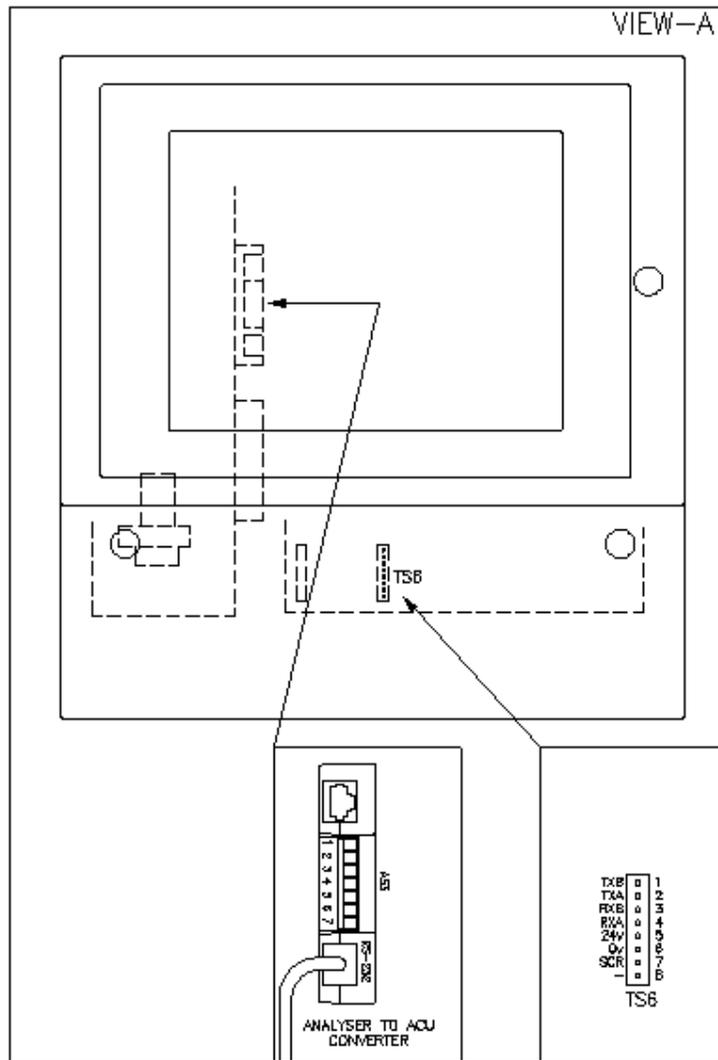


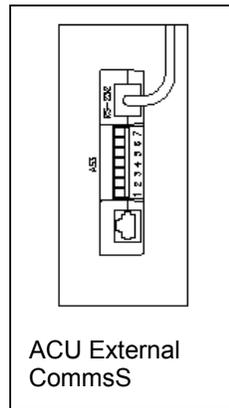
Figure 3-5 ACU Connection to Analyser (Extract from Drawing 7-2497-02 sheet 3 of 3)

The connection from the ACU to the analyser will depend on whether the ACU has been supplied with the optional I/O Board, connections will be as follows

Analyser (AU) to ACU with I/O Board Interconnection (See Drawing 7-2497 2 of 3 for further details)		
Function	AU	ACU
Data Return B	TS1-1	TS6-1
Data Return A	TS1-2	TS6-2
Data Out B	TS1-3	TS6-3
Data Out A	TS1-4	TS6-4
Screen		TS6-7

Analyser (AU) to ACU without I/O Board Interconnection (See Drawing 7-2497 2 of 3 for further details)			
AU Function	AU	Analyser to ACU Convertor	
Pair A	RXA	TS1-4	Pin – 1
	RXB	TS1-3	Pin – 2
Ground Unused			
Pair B	TXA	TS1-2	Pin – 3
	TXB	TS1-1	Pin – 4

### Connecting to External Communication (Digital)



ACU External RS485 Comms Connections	
ACU Function	ACU External Comms
TXD+(B)	Pin - 1
TXD-(A)	Pin - 2
RXD+(B)	Pin - 3
TXD-(A)	Pin - 4

Figure 3-6 ACU Connection to external communications for example plant DCS  
(Extract from Drawing 7-2497-02 sheet 3 of 3)

### Connecting - Lan Ethernet

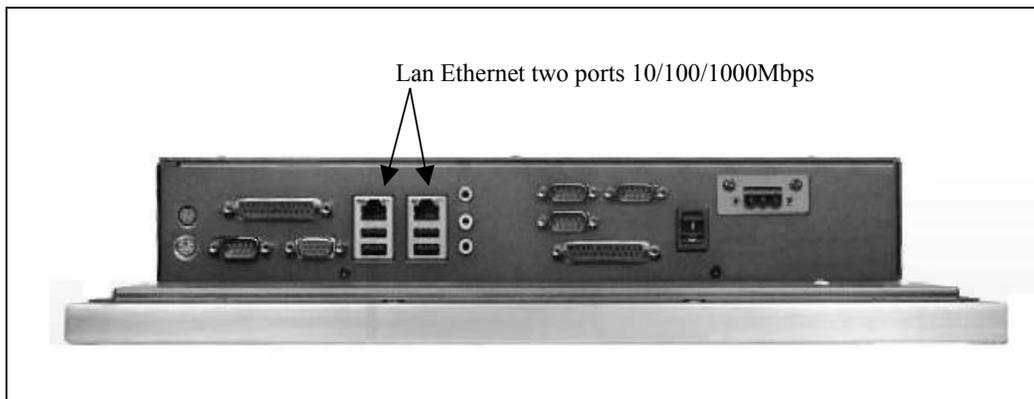


Figure 3-7 ACU Connection to Lan Ethernet (Image of underside of panel PC)

### Connecting – USB Printer / Memory Stick

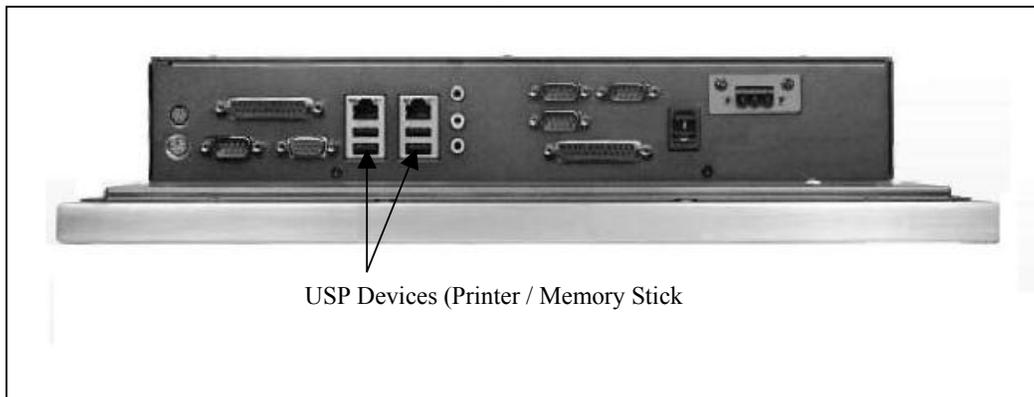


Figure 3-8 ACU Connection to printer / memory stick (Image of underside of panel PC)

## Connecting - Analogue / Digital I/O

The optional Input Output Units is mounted in the ACU enclosure to provide addition inputs, current outputs and relay outputs to any system.

Each unit can provide up to 32 Input or Output Modules (mixed allocation), has up to 32 Relays and provides 16 Digital Inputs.

The controller software can allocate any channel to any output, any alarm to any relay and configure any input as an additional channel.

All Input Modules and Output Modules are fully isolated. The Relay outputs are voltage free and the Digital Inputs are isolated in voltage or current mode.

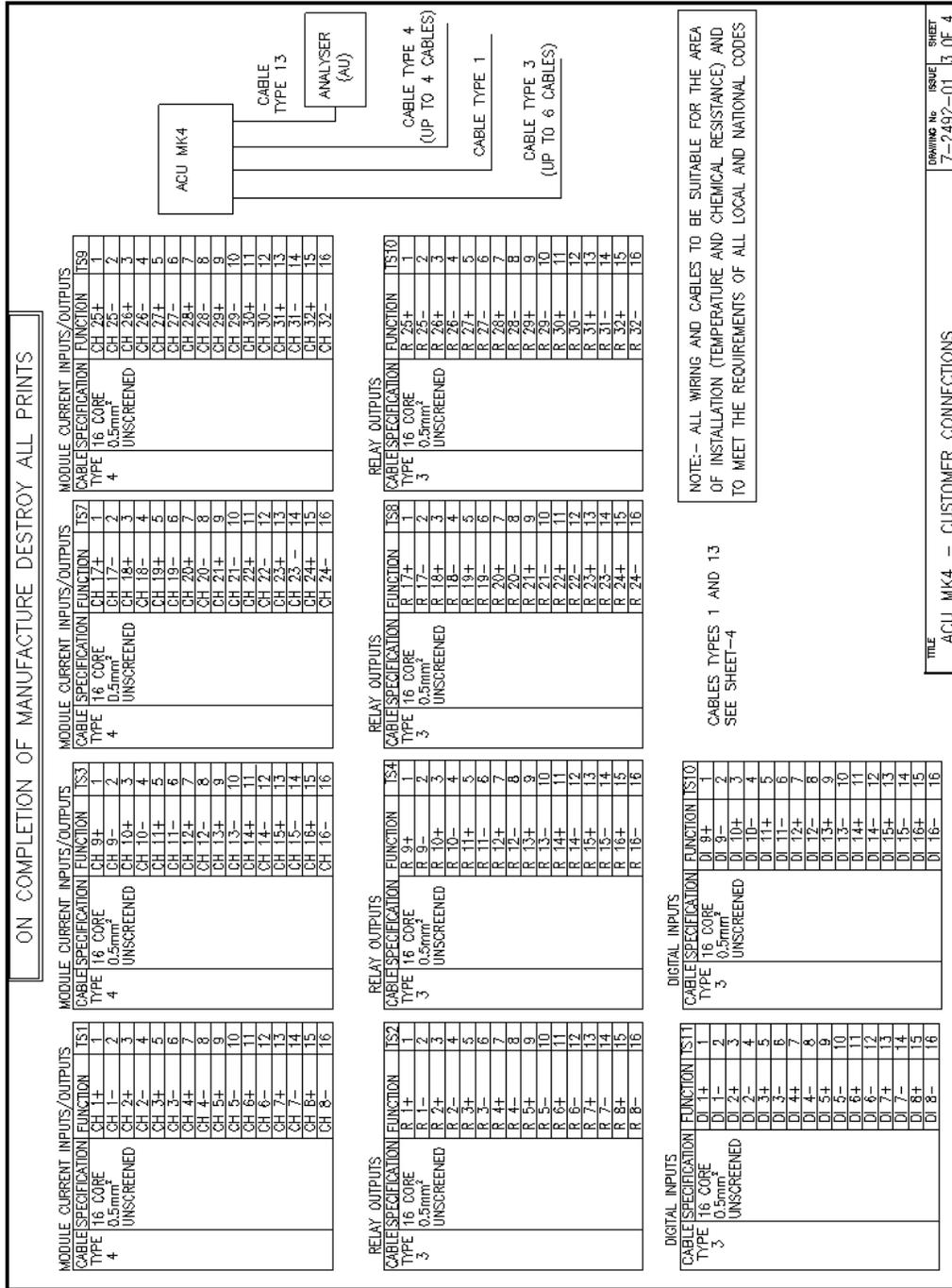
The addressing of the units by the controller does not affect the system ability to address Analysers.



### Preparing cables for the I/O

During preparation of the IOU, you should refer to the relevant installation drawing in the *Order-specific information* section of the accompanying system, particularly if you will be making up your own interconnecting cables.

The typical cables used to connect other system components to the IOU are shown in Figure 3.10 and 3.11.



**NOTE:- ALL WIRING AND CABLES TO BE SUITABLE FOR THE AREA OF INSTALLATION (TEMPERATURE AND CHEMICAL RESISTANCE) AND TO MEET THE REQUIREMENTS OF ALL LOCAL AND NATIONAL CODES**

**CABLES TYPES 1 AND 13 SEE SHEET-4**

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ACU MK4 - CUSTOMER CONNECTIONS

**DRAWING No**  
7-2492-01

**ISSUE**  
3 OF 4

**SHEET**  
3 OF 4

Figure 3.10 – Interconnection Cables

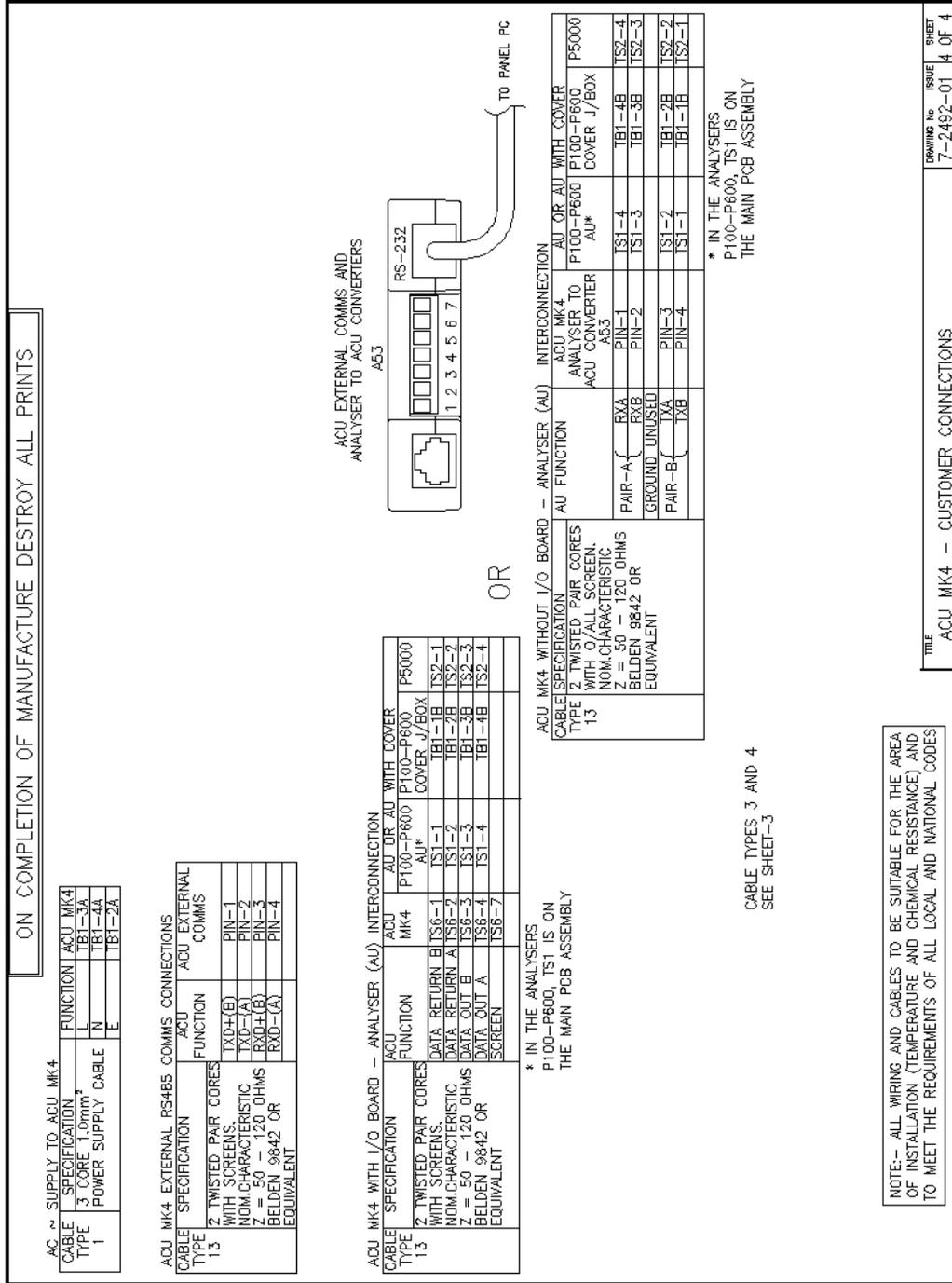


Figure 3.11 – Interconnection Cables

### **System configuration**

The System Database provided will be configured to suit the Inputs and Outputs configurations ordered. If changes need to be made consult the relevant section in the ACWn Controller Manual.

### **Module configuration**

See IOU Configuration Sheet (7-7806) form entries for this delivery Module setup details.

See IOU Customer Connections drawing 7-4384 for Module locations, Relay Links and Digital Input Link locations.

Output Modules – No configuration required.

Input Modules – Link selection for three modes.

J2 in, J1 out for 0-20mA or 4-20mA range.

J2 and J1 out for 5V range.

J1 and J2 in for Switch detection.

Digital inputs. – Link selection for four detection modes.

Links A, B, C out; 24V Logic.

Link B in.; 5V or 20mA Logic.

Links A, B, C in; Contact detection.

Relay Outputs – Link selection for NO (Normally Open) and NC (Normally Closed) operation. When powered off the IOU relays will be in the Normal position. By default the error condition is this power off condition.

Relay Rating - 28V dc max, 1A max.

Not suitable for mains switching nor signal switching.

## Operation

NOTE: If the IOU is powered without communications from the Control Software then all relays will be in their alarm state and all current transmitters will output 2mA. A timeout is provided after communications is established to ensure the above occurs only in the case of a communications fault.

The Output Modules have an LED on the module which is illuminated in an Error condition. This error is the result of the Module being unable to create any current output. This will normally be because the output for this module is open circuit. Hence these LEDs can be used to check the system wiring. Note this requires operating the IOU with the cover removed. This should only be done by a qualified service engineer and the earlier warning as to operation on Mains Voltage applies.

## Connecting the system to the supply

The ACU has been designed to operate on either of two power supplies:

- 110 V ac nominal (low limit 85 V, high limit 130 V), 50-60 Hz.
- 230 V ac nominal (low limit 190 V, high limit 264 V), 50-60 Hz.

No user adjustment is necessary as the ACU automatically detects the input voltage. The procedure to connect the system to the mains supply is:

1. Ensure that all wiring between the ACU, Analysers(s) (AU)s and ancillary equipment is correct.
2. Connect the free end of the mains cable to a suitable ac supply. Follow local regulations for permanently installed equipment. It is recommended as good practice that a means of disconnection is provided within 2 meters and an RCD or ELB is also fitted.

The installation is now complete and the system is ready for operation.

The electrical connections are detailed on drawing 7-2492.

# 4 Software Operation and configuring

See **Analyser Control For Windows For Network** operating manual 7-3038 supplied with ACU

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