User Guide

Duty Assist

Application Software

solutions

Option Module
For Unidrive

Part Number: SSP-3100-0281
Issue Number: 1

 SAFETY INFORMATION

Persons supervising and performing the electrical installation or maintenance of a Drive and/or an external Option Unit must be suitably qualified and competent in these duties. They should be given the opportunity to study and if necessary to discuss this User Guide before work is started.

The voltages present in the Drive and external Option Units are capable of inflicting a severe electric shock and may be lethal. The Stop function of the Drive does not remove dangerous voltages from the terminals of the Drive and external Option Unit. Mains supplies should be removed before any servicing work is performed.

The installation instructions should be adhered to. Any questions or doubt should be referred to the supplier of the equipment. It is the responsibility of the owner or user to ensure that the installation of the Drive and external Option Unit, and the way in which they are operated and maintained complies with the requirements of the Health and Safety at Work Act in the United Kingdom and applicable legislation and regulations and codes of practice in the UK or elsewhere.

The Drive software may incorporate an optional Auto-start facility. In order to prevent the risk of injury to personnel working on or near the motor or its driven equipment and to prevent potential damage to equipment, users and operators, all necessary precautions must be taken if operating the Drive in this mode.

The Stop and Start inputs of the Drive should not be relied upon to ensure safety of personnel. If a safety hazard could exist from unexpected starting of the Drive, an interlock should be installed to prevent the motor being inadvertently started.

GENERAL INFORMATION

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional operating parameters of the equipment or from mismatching the Drive with the motor.

The contents of this User Guide are believed to be correct at the time of printing. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the contents of the User Guide, without notice.

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System File	>= V02.08.01
CTIU File	V01.00.00

Contents

1   Introduction

1.1   Who Should Read This Manual?

This manual is intended to assist the engineer in commissioning the application software, and should be read in conjunction with the documentation that is supplied with the drive and other associated hardware. The safety systems that are required to prevent risk of injury to persons operating or maintaining the machine are not discussed in this manual. The engineer must be familiar with and able to implement the required safety systems. This manual assumes that the engineer is familiar with relevant Control Techniques products and understands the requirements for the application.

If you do not feel confident of the above, then you should contact your local Control Techniques drive centre or distributor to obtain service / advice.

1.2   Application Overview

The Duty-Assist control is an effective method of controlling multiple pumps or fans in parallel, to maintain the required process demand.

Pumps and fans are often used in parallel banks to: -

- Avoid motor Overload,
- Guaranteed security of supply, (system redundancy.)
- Reduce running cost due to system load cycles.
- Provide wide range of control & flexibility.

The system consists of a 'Duty' VTC Unidrive and assist starters. The assist starters can be of any type, (e.g. D.O.L, Star-Delta, Auto-Transformer, Soft Starter or Inverter); the choice is dependant on the system limits.

The Duty VTC drive can control one dedicated motor ('Fixed Duty'), or with additional external switchgear could be selected to control other motors within the parallel configuration (Flexible Duty).

The Duty is controlled by a PID loop which will maintain the process level required, if the demand exceeds the capacity that can be derived from the Duty, then an Assist starter will be enabled to assist with the delivery. If the demand continues to increase additional starters will be called. When the demand decreases, then each assist starter will be deselected to reduce the delivery to the required demand.

Typically in a parallel bank of four, it is usual to find three running and one standby. The Duty assist can control up to 4 assist starters with a 'Fixed Duty', and 3 assist starters with a 'Flexible Duty' selection.

One UD70 Application Module, located within the Duty VTC Unidrive achieves all the system control. The standard and optional I/O on the drive provides the I/O interfacing to the other starters and the process.

Typical processes that can be controlled with parallel configurations using the Duty-Assist software are: -

1. Pressure.
2. Flow.
3. Temperature.
4. Tank/reservoir Level.
5. Sewage aeration.

Typical Configuration for controlling Cooling Towers in temperature control:
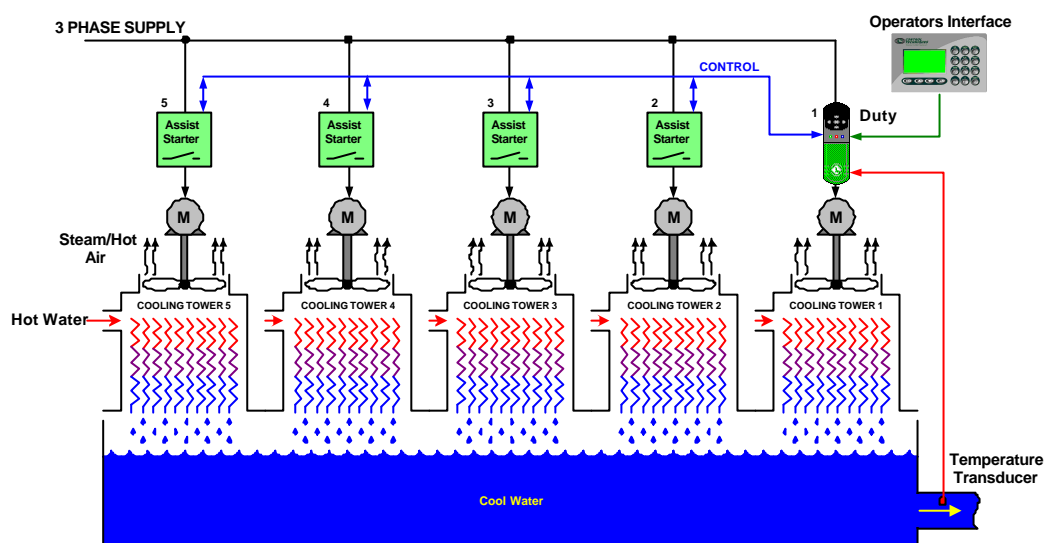
1.2.1 Parallel Operation of Fans or Pumps

Contrary to commonly held beliefs; the flow does not double on addition of a second similar pump/fan in parallel. In fact each successive pump or fan adds a smaller amount to the total system pressure and flow, although the total flow is split equally between each pump/fan.

Typical System Curves for parallel pump/fan operation
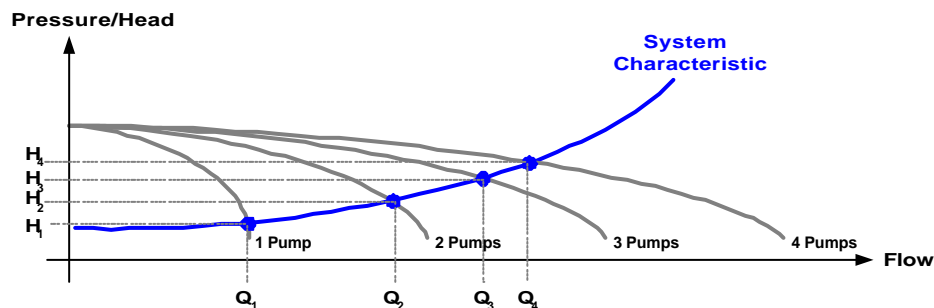
1.2.2 Features

- Fixed Duty Motor - up to 4 Assist starters can be controlled
- Flexible Duty Selection - up to 3 Assist starters can be controlled.
- Assist or Duty selection can be by Runtime or by a set sequence.
- Automatic reselection if the requested assist fails to start.
- Local/Remote; Digital control selection from the Unidrive terminal I/O or via fieldbus
- Standalone or system configurable
- Set points and feedbacks can be derived as direct analogue signals or by fieldbus.
- Process High and Low trip thresholds, (selectable).
- Inverse Speed characteristic, (selectable).
- No Flow Protection, (selectable).
- Wake/Sleep, energy save function, (selectable).
- Dynamic V/F, energy save function, (selectable).
- Cascade System Stop, (selectable).
- Two selectable preset process set points for day/night control with external clock. (Standard feature when CTIU is used with real time clock function).
- Auto-changeover to ensure starters is not continually running for long periods of time, (selectable).
- Assists Number of starts per Hour protection, (selectable).
- Assist Override to react to peak demands, (selectable).
- All data set up in Real Engineering Units.
- Optional Fieldbus Interfaces: Profibus-DP, Interbus, DeviceNet, Modbus-Plus, Modbus, CTNet, CANopen & CAN.
- CTIU110 operator Interface compatible.

2   Mechanical Installation

Ensure the Unidrive is correctly installed in accordance to the Unidrive Installation Manual

2.1   Application Module & Unidrive

- Isolate the Drive from the main supply and allow 5 minutes for the DC Bus capacitors to discharge.

- Insert the Duty-Assist Application Module as shown below. Ensure that it is correctly inserted. The module will click firmly into place.

- The Unidrive must be disconnected from the mains supply before installing or removing any of the option modules.

2.1.1   Application Module

- To remove the module, pull on the black tab, and the module will disengage from the connector and pull out of the Drive.
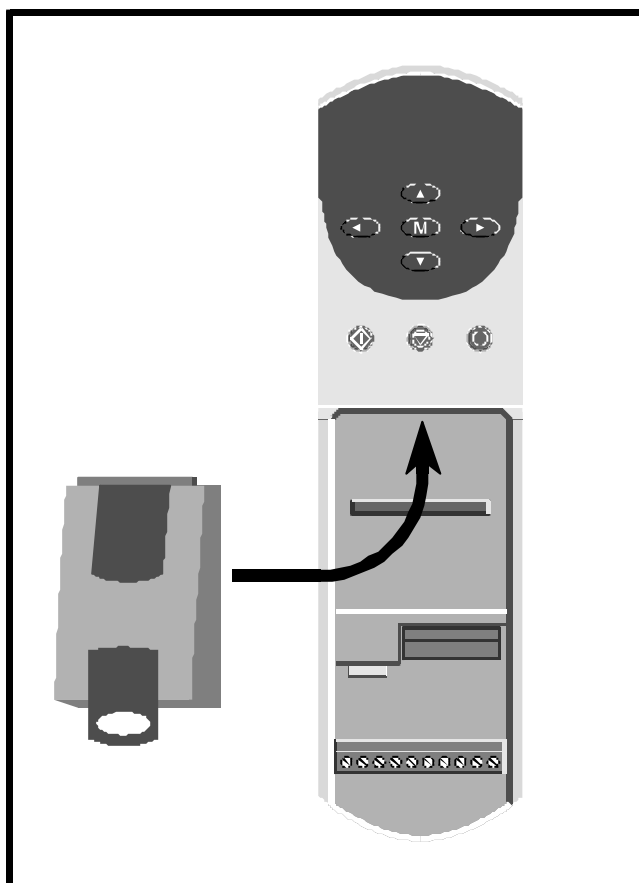
2.1.2   Additional I/O Option Module

Locate the module as show in the diagram below, and push into place.
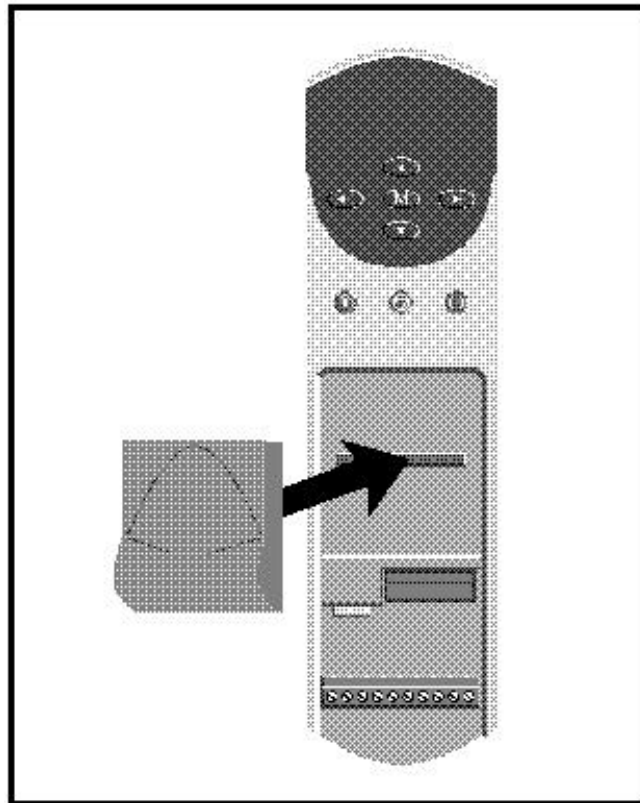
3 Electrical Installation

3.1 Power Supplies

3.1.1 Control

+24V digital supply (Terminal 22)

Supply for external digital signal devices.

Voltage Tolerance:	±10%
Nominal output current:	200mA
Overload output current:	240mA
Protection:	Current fold-back above 240mA

+10V analogue supply (Terminal 4)

Supply for external analogue signal devices

Voltage Tolerance:	±1%
Nominal output current:	10mA
Protection:	Current limit and thermal trip

3.1.2 Power / Motor Connections

Please refer to the Unidrive documentation for the relevant information regarding:

- Voltage Rating
- Current rating
- Motor Connections

3.2 Analogue Set points and Feedbacks

3.2.1 Specification

Analogue Inputs

Specification	Unidrive I/O	Optional I/O
Type of Input:	1 x Differential 1 x Single-ended	Single-ended
Max. output voltage:	-10V to +10V	-10V to +10V
Input resistance:	100 kohm	20 kohm
Absolute Maximum Input	± 24 V with respect to 0 V	± 24 V with respect to 0 V
Resolution:	Differential = 12-bit plus sign Single-ended = 10-bit plus sign	10-bit plus sign
Update period:	5.5ms / 7.4ms	8mS

Analogue Outputs

Specification	Unidrive I/O	Optional I/O
Type of output:	Single-ended	Single-ended
Max. output voltage:	-10V to +10V	-10V to +10V
Load resistance:	> 1 kohm	> 1 kohm
Protection:	Short-circuit proof	Short-circuit proof
Resolution:	10-bit plus sign	10-bit plus sign
Update period:	5.5ms / 7.4ms	8mS

3.2.2 Analogue Signal Types

UNDRIVE ANALOGUE INPUTS

The Unidrive analogue inputs can accept current or voltage signals as tabulated below.

Number	Parameter Mnemonic	Signal Type
0	VOLt	+/- 10V input
1	0 - 20	0 – 20mA
2	20 - 0	20 – 0mA
3	4-20.tr	4 – 20mA (Trip on loss)
4	20-4.tr	20 – 4mA (Trip on loss)
5	4-20.Lo	4 – 20mA (Min (or low) speed on loss)
6	20-4.Lo	20 – 4mA (Min (or low) speed on loss)
7	4-20.Pr	4 – 20mA (Previous speed on loss)
8	20-4.Pr	20 – 4mA (Previous speed on loss)
9	Th.SC	Motor Thermister with trip on short circuit detection*
10	Th	Motor Thermister without short circuit detection*

Each analogue input signal type is configured by the following parameters;

07.06 – Analogue Input 1, Terminal 5 & 6 (Process Feedback Signal).

07.11 – Analogue Input 2, Terminal 7 (Process/Speed Set point Signal).

07.15 – Analogue Input 3, Terminal 8 (Thermister).

Note: Analogue Input 3 is the only input that can be configured for a motor thermister.

UNDRIVE ANALOGUE OUTPUTS

The Unidrive analogue Outputs can derive current or voltage signals as tabulated below.

Number	Parameter Mnemonic	Signal Type
0	VOLt	Output range ±10V.
1	0 – 20	Output range 0 - 20 mA.
2	4 – 20	Output range 4 - 20 mA.

Each analogue output signal type is configured by the following parameters;

07.21 – Analogue Output 1, Terminal 9 (Motor Frequency)

07.24 – Analogue Output 2, Terminal 10 (Process Feedback Signal)

OTHER INDUSTRIAL SIGNALS

Interfacing to the Unidrive analogue inputs with other industrial feedback sources, like resistive sensing PT100, Thermocouples, etc an external signal converter is required.

3.2.3   Unidrive Analogue I/O Allocation

The <u>Default</u> analogue I/O signals are allocated as tabulated below:

UNIDRIVE STANDARD ANALOGUE I/O					
No	**Description**	**Term No.**	**I/O**	**Res.**	**Type**
AI1	Process Feedback	5&6	Input	12bit+ sign	Diff
AI2	Process/Speed Setpoint	7	Input	10bit+ sign	SE
AI3	Thermister Protection	8	Input	10bit+ sign	SE
	0v	3	-	-	-
	+10Vdc	4	-	-	-
A01	Motor Frequency		Output	10bit+ sign	SE
A02	Process Feedback		Output	10bit+ sign	SE
-	0v	11	-	-	-

Notes: SE – Denotes Single Ended: Diff – Denotes Differential Signal.

UNIDRIVE ADDITONAL I/O OPTION					
No	**Description**	**Term No.**	**I/O**	**Res.**	**Type**
AI4	Speed analogue Ref.1 (N/A for application)	51	Input	10bit+ sign	Diff
AI5	Speed analogue Ref.2 (N/A for application)	52	Input	10bit+ sign	SE
A03	Motor Current	54	Output	10bit+ sign	SE
-	0v	53,55	-	-	-

3.2.4 Typical Analogue Set-point & Feedback Connection Diagram

Example 1 (with differential voltage Feedback signal)
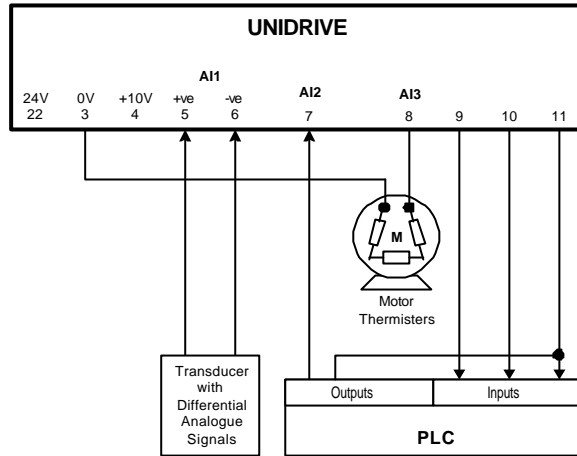
Example 2 (with single-ended current Feedback signal)
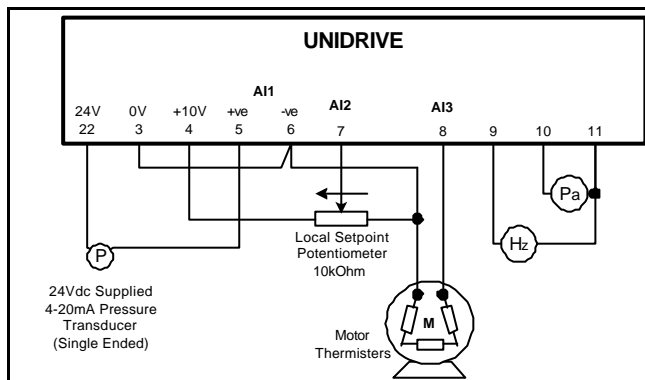
3.3   Digital I/O

3.3.1   Specification

Digital Input/Outputs

Specification	Unidrive I/O	Optional I/O
Type of Input/output:	*Negative logic Input. Push-pull output	*Negative logic Input. Push-pull output
Voltage range:	- 0V to +24V	- 0V to +24V
Absolute max. Voltage range:	-3V to +30V	> 1 kohm
Logic levels:	High: >+15V Low: <+5V	High: >+15V Low: <+5V
Input current @ +24V	3.2mA	3.2mA
Output current	100mA	10mA
Overload	120%	120%
Update period:	5.5ms / 7.4ms	8ms

Digital Inputs

Specification	Unidrive I/O	Optional I/O
Type of Input:	*Negative logic	*Negative logic
Voltage range:	- 0V to +24V	- 0V to +24V
Absolute max. Voltage range:	-3V to +30V	> 1 kohm
Logic levels:	High: >+15V Low: <+5V	High: >+15V Low: <+5V
Input current @ +24V	3.2mA	3.2mA
Update period:	5.5ms / 7.4ms	8ms

*Drives with firmware V2.10.4 and later allow the selection of either negative logic or positive logic on the inputs. Selection is made with parameter 08.27.

Relay Outputs

Specification	Unidrive I/O	Optional I/O
Contact Voltage Rating	250Vac	250Vac
Max Current	5A Inductive 1A Resistive	1A Resistive
Contact Isolation	3kV	High: >+15V Low: <+5V

3.3.2 Polarity of Logic

The logic polarity can be configured for 'Positive Logic (Sink)' or 'Negative Logic (Source). The 24Vdc supply can be sourced locally from the Unidrive (Terminal 22) or from an external power supply.

Positive Logic Select Parameters

Unidrive Standard Digital I/O = 08.27.

Unidrive Optional Digital I/O = 16.40.

NOTE

Ensure the 200mA current capacity is not exceed when using the Unidrive 24Vdc supply.

3.3.3 Suppression

To help reduce magnetic transient interference, qait recommended that all contactor, relay and actuator coils are suppressed, with diodes on dc circuits, or RC configurations on ac circuit.

3.3.4 Unidrive Digital I/O Allocation

There are 3 selectable digital I/O terminal allocations as follows:-

Mode 0 – No Default Allocation

Parameter 19.25 = 0

This mode allows complete flexibility in defining I/O allocation. It is recommended the user consult the Unidrive user manual regarding how to redefine the Digital I/O mappings.

Mode 1 – Unidrive Only

Parameter 19.25 = 1

This mode only optimises the standard Unidrive terminal I/O and only allows up to two external starters to be controlled.

UNIDRIVE STANDARD I/O			
No	Description	Terminal	I/O
F1	Starter 1 Available	24	Input
F2	Starter 1 Running / Duty Ack.	25	Input
F3	Starter 1 Run	26	Output
F4	Starter 2 Available	27	Input
F5	Starter 2 Running / Duty Ack.	28	Input
F6	System Run	29	Input
F7	Inhibit	30	Input
F8	Starter 2 Run	1 & 2	Relay Output
	+24Vdc, 200mA Supply	22	-
	0v Supply	23 & 31	-

Mode 2 – Unidrive Plus additional I/O Option Module

Parameter 19.25 = 2

This mode configures the Unidrive and the Additional I/O and can control up to 4 external starters.

UNIDRIVE STANDARD I/O			
No	Description	Terminal	I/O
F1	Starter 1 Available	24	Input
F2	Starter 1 Running / Duty Ack.	25	Input
F3	Starter 1 Run	26	Output
F4	Starter Reset	27	Input
F5	Starter Auto Select	28	Input
F6	System Run	29	Input
F7	Inhibit	30	Input
F8	Starter 2 Run	1 & 2	Relay Output
	+24Vdc, 200mA Supply	22	-
	0v Supply	23 & 31	-

NOTE: Each Unidrive digital output is capable of driving a maximum of 100mA.

No	Description	Terminal	I/O
**UNIDRIVE ADDITONAL I/O OPTION**
F9	Starter 2 Available	48	Input
F10	Starter 2 Running / Duty Ack.	49	Input
F11	Starter 3 Available	50	Input
F12	Starter 3 Running / Duty Ack.	44	Input
F13	Starter 4 Available	45	Input
F14	Starter 4 Running / Duty Ack.	46	Input
F15	Starter 3 Run	40	Relay Output
F16	Starter 4 Run	41	Relay Output
		42	Relay Com.
	0v Supply	43 & 47	-

NOTE: Each Option digital output is capable of driving a maximum of 10mA.

3.4   Fixed Duty Configurations

3.4.1   Power scheme
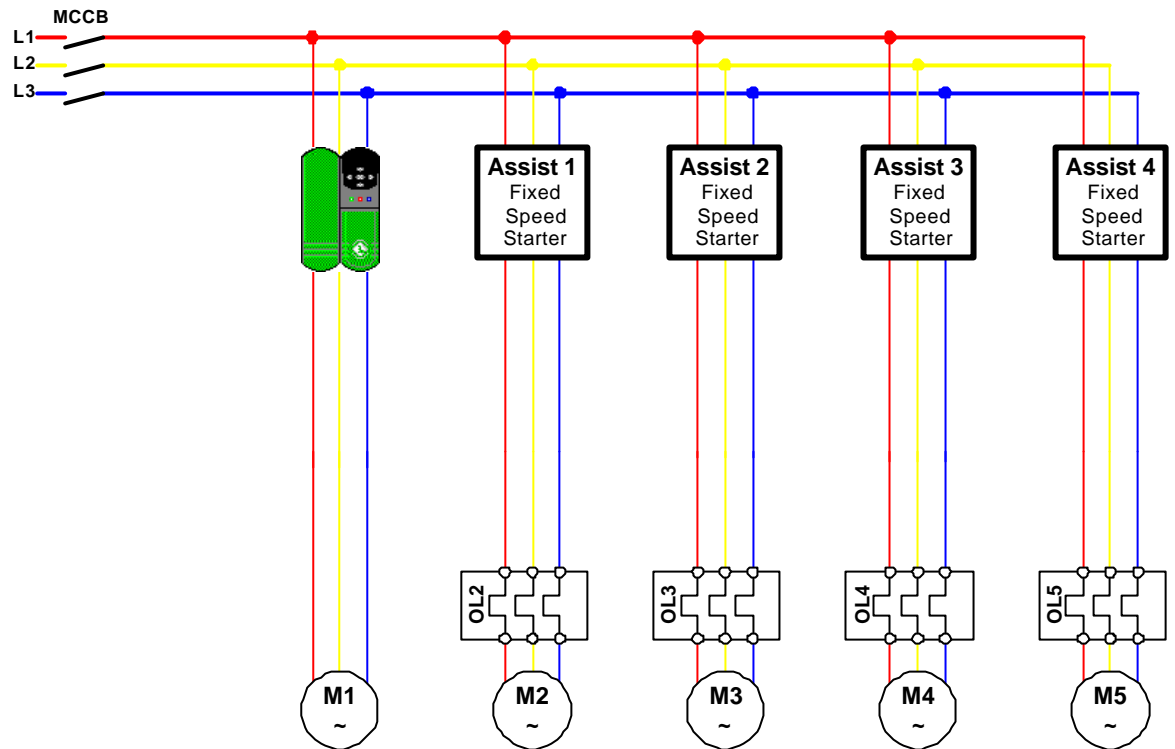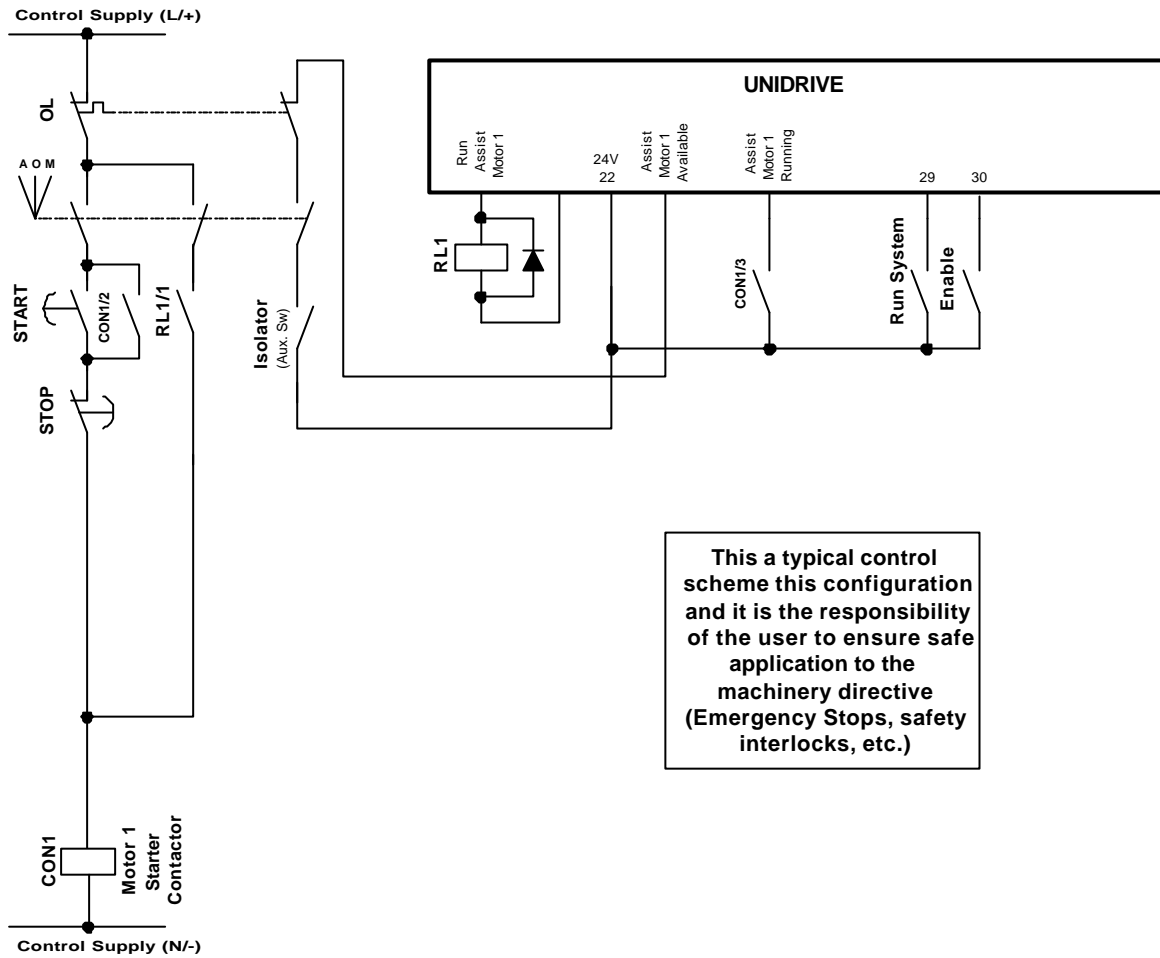
3.4.2   Control Scheme
With local Auto/Man selection on each starter

This a typical control
scheme this configuration
and it is the responsibility
of the user to ensure safe
application to the
machinery directive
(Emergency Stops, safety
interlocks, etc.)

Without local Auto/Man selection on each starter

Control Supply (L/+)

OL

RL1/1

Isolator (Aux. Sw)

UNIDRIVE

Run Assist Motor 1

24V 22

Assist Motor 1 Available

Assist Motor 1 Running

29   30

RL1

CON1/3

Run System

Enable

This a typical control scheme this configuration and it is the responsibility of the user to ensure safe application to the machinery directive (Emergency Stops, safety interlocks, etc.)

CON1

Motor 1 Starter Contactor

Control Supply (N/-)
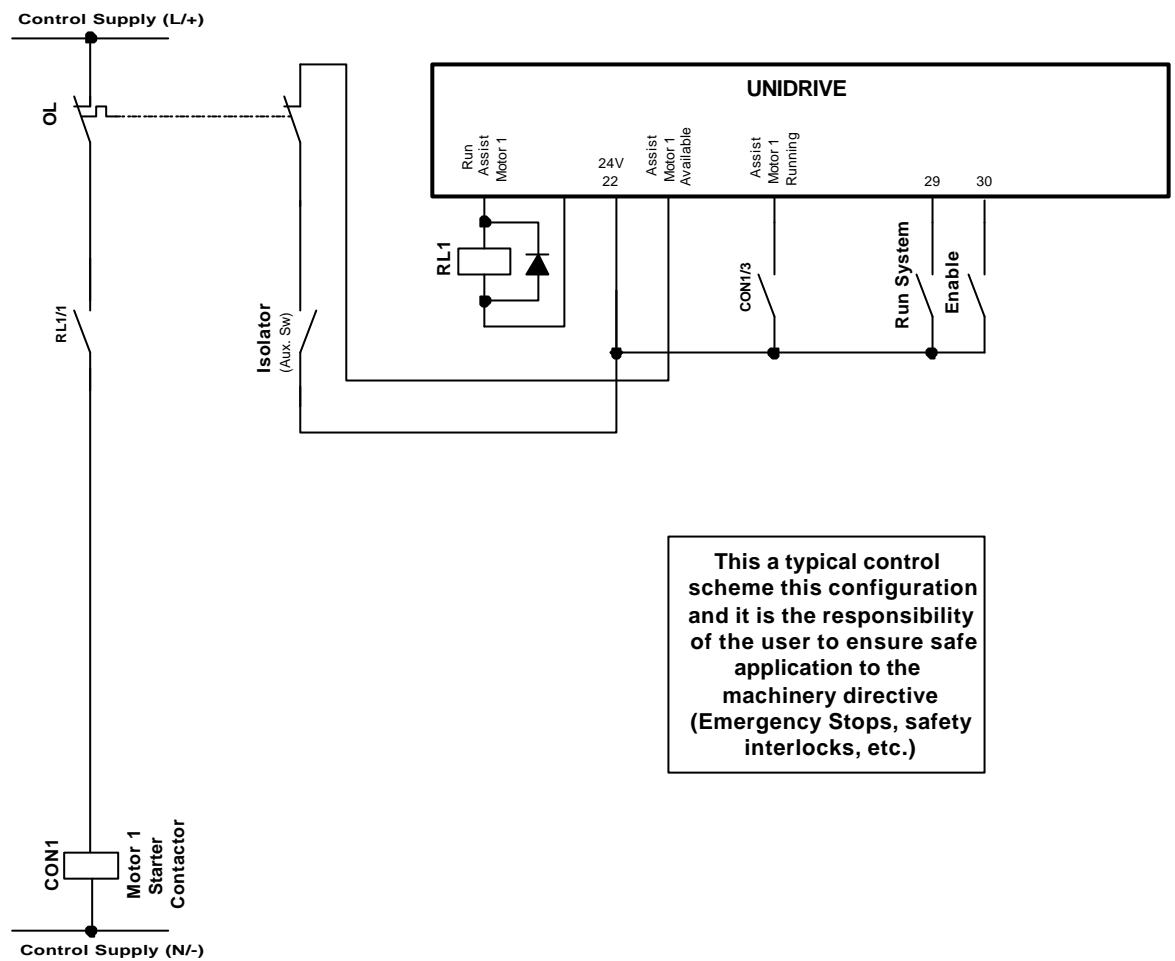
3.4.3 Unidrive Digital I/O Allocation

Ref to section 3.3.2

3.5 Flexible Duty Configurations

3.5.1 Power scheme
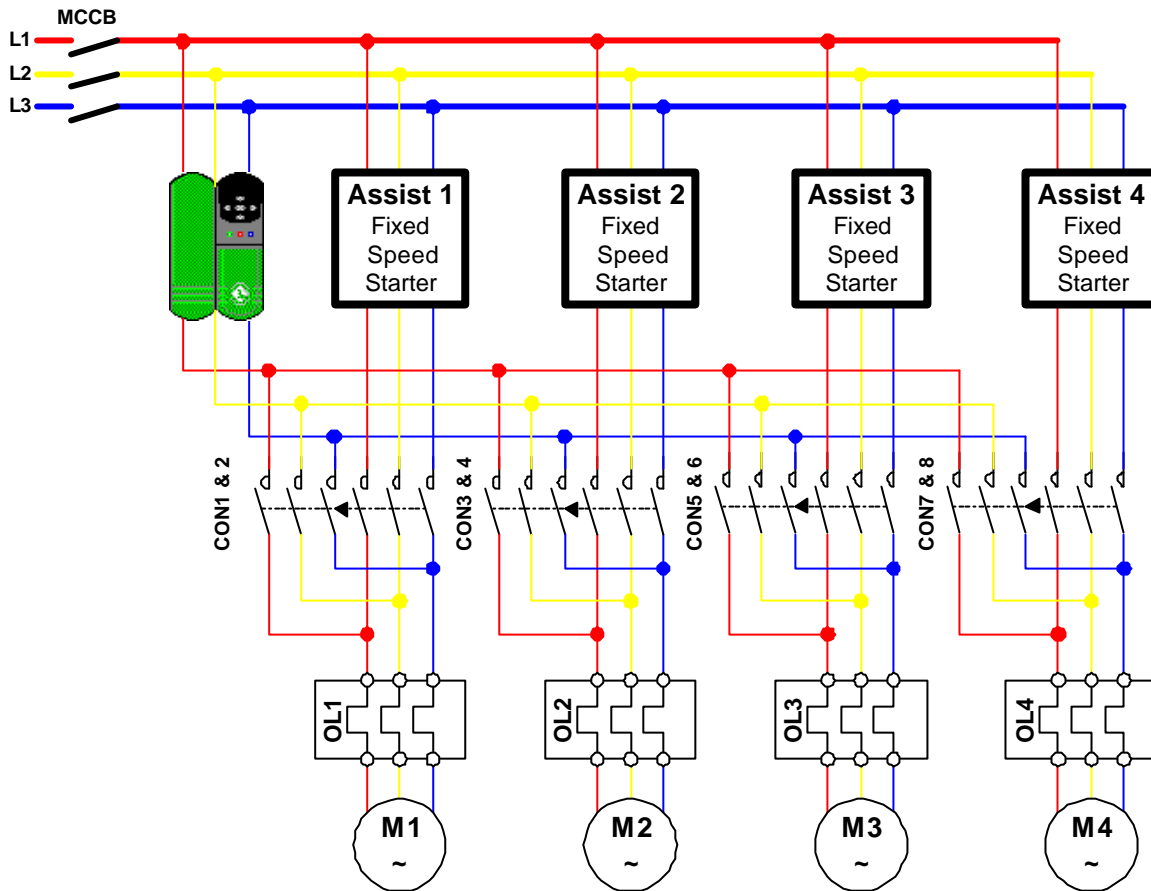
NOTE

A Mechanical interlock must be used between the duty and starter selection contactors. (e.g. with reference to diagram above CON1 & 2, CON3 & 4, CON5 & 6 and CON7 & 8).

3.5.2 Control Scheme
With local Auto/Man selection on each starter
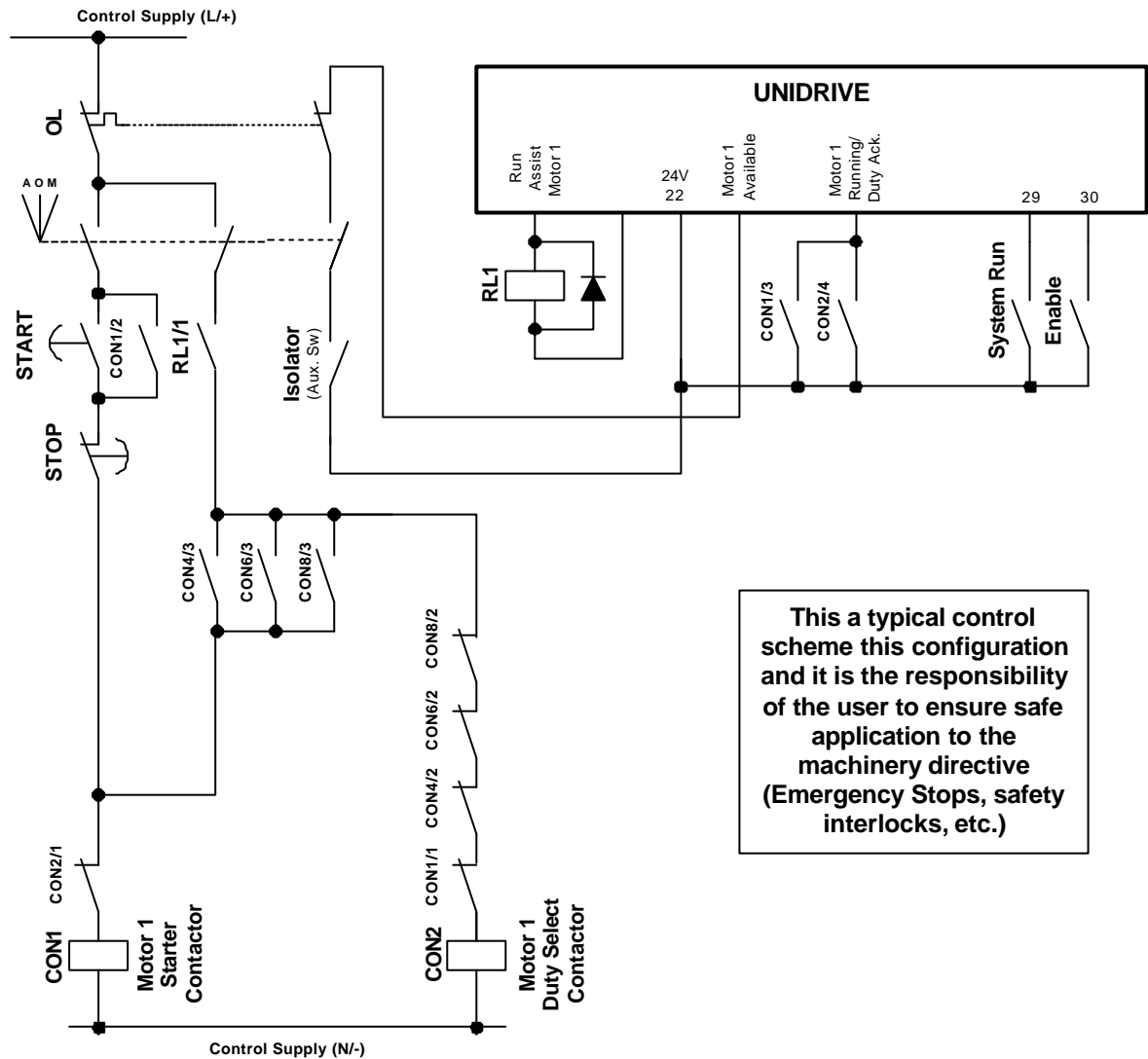
This a typical control scheme this configuration and it is the responsibility of the user to ensure safe application to the machinery directive (Emergency Stops, safety interlocks, etc.)

Without local Auto/Man selection on each starter

Control Supply (L/+)

OL

RL1/1

UNIDRIVE

Run Assist Motor 1

24V 22

Motor 1 Available

Motor 1 Running/ Duty Ack.

29   30

Isolator (Aux. Sw)

RL1

CON1/3

CON2/4

System Run

Enable

CON4/3

CON6/3

CON8/3

CON8/2

CON6/2

CON4/2

CON1/1

CON2/1

CON1

Motor 1 Starter Contactor

CON2

Motor 1 Duty Select Contactor

Control Supply (N/-)
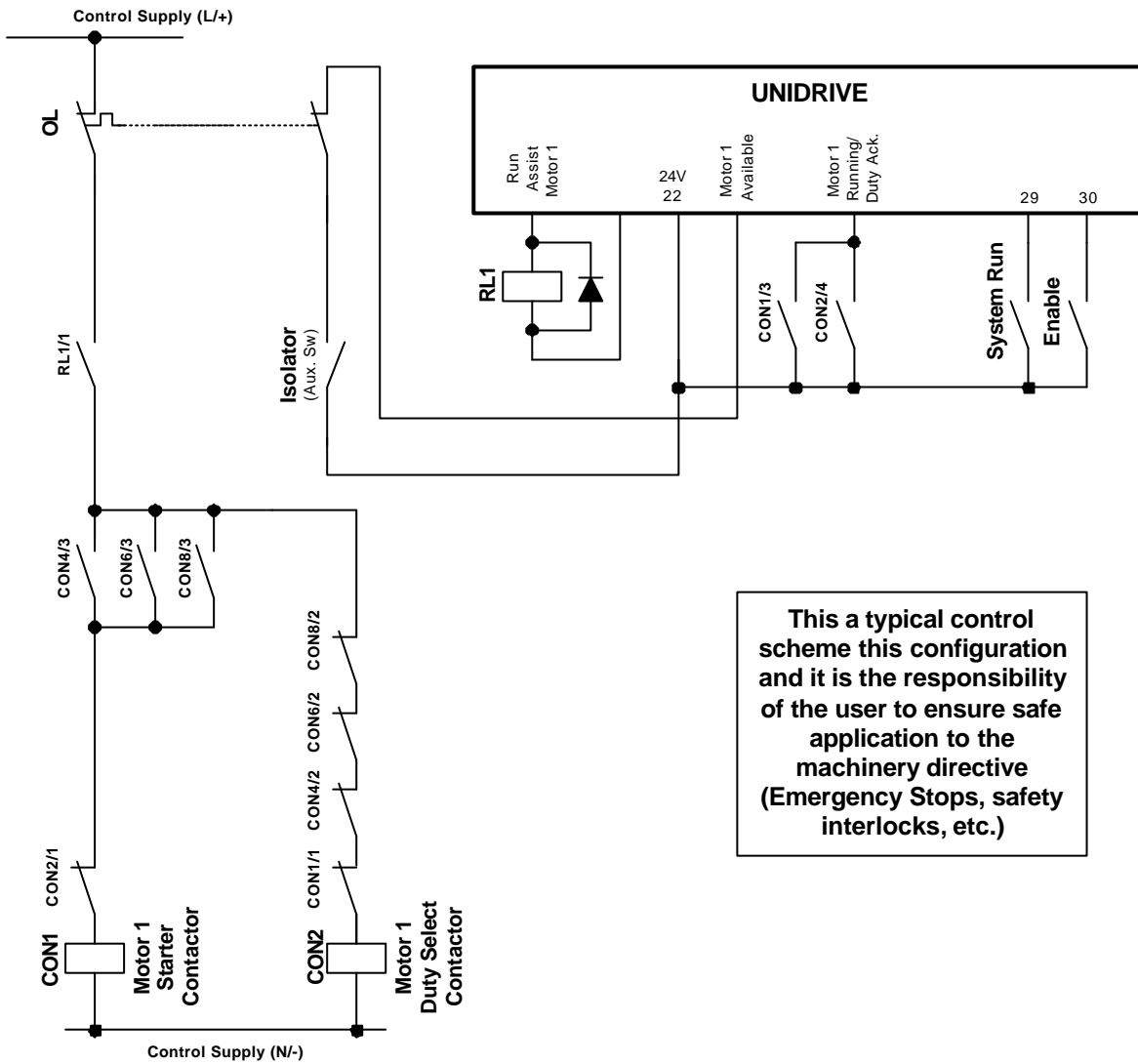
> This a typical control scheme this configuration and it is the responsibility of the user to ensure safe application to the machinery directive (Emergency Stops, safety interlocks, etc.)

3.5.3   Unidrive Digital I/O Allocation
Ref to section 3.3.2

3.6   Application Module Connections

Connectors C and D on the Application module are the RS232 programming port (C) and RS485 general-purpose communications port (D) of the UD70.

Connectors A and B are reserve for fieldbus connections.

A   **B**

C   **D**

RS232 Port   RS485 Port
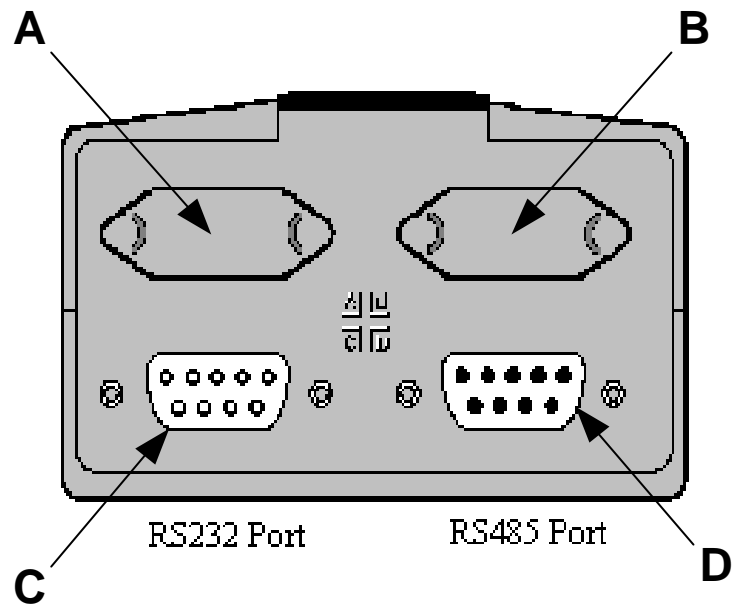
Pin	RS232 Port Allocation(C)	RS485 Port Allocation(D)
1		0v
2	TXD.	/TXD
3	RXD.	/RXD
4		Digital Input 0 (TTL)
5	0V.	Digital Input 1 (TTL)
6		TXD
7		RXD
8		Digital Output (TTL)
9		0V Digital

4   Software Installation

There are two software files that are required to be installed within the Application module, these are as follows: -

        1.   Application file   - DutyAss.bin

        2.   System file   - This is dependant on the application and fieldbus interface used.

             UD70OS.SYS   - UD70 Application module only

             UD70NET.SYS   - UD70 and CTNet

             IBSPROFI.SYS   - UD70 and Profibus-DP or Interbus

             DNET.SYS   - UD70 and Devicenet

             MBPLUS.SYS   - UD70 and Modbus-Plus

             DPLCAN.SYS   - UD70 and CAN

             CANOPEN.SYS   - UD70 and CANopen

The following parameters indicate the installed software version. '0' denotes no software file is installed.

Parameter	Description	Parameter Notation
17.02	System file version number	2.81 = V02.08.01
20.49	Application file version number	20801 = V02.08.01

To download the system and/or the application file to the application module the following items are required: -

- A standard one to one serial cable connected between the PC serial port and the RS232 port on the application module, (Connector C).
- Control Techniques Windows™ 'WinFlasher' software. This software is available from any Control Techniques drive centre, or comes complete with 'Sypt' programming tool.

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5   Getting Started

5.1   Unidrive

1.   It is recommended to commission the Unidrive in OPEN LOOP mode before attempting to set up the Duty Assist Application. Consult the Unidrive/VTC Getting Started Manual for more details.

2.   For guidance, all or some of the related parameters that are listed in section 5.1 may need to be configured.

3.   Ensure parameter 17.13 = 1. This enables the Duty-Assist software to auto-run on power up. If not set perform the following procedure: -

    i.   Set parameter 17.13 = 1

    ii. Set parameter 00.00 = 1000 and press the reset. This will save all current settings of parameters in menus 1 to 19 to non-volatile memory.

    iii. Set parameter 00.00 = 1070 and press the reset. This will reboot the application module and run installed application software

5.2   Duty-Assist

The following details a simple procedure for getting started with the Duty assist application software. Optional features such as the sleep function, Cycle function, Start per hour protection, No flow protection and the process alarm are not detailed in this section. For information on these features refer to the relevant functional description in section 6.

1.   Switch off the Unidrive. Insert the Application module and additional I/O module as detailed in section 2.1.1 & 2.1.2.

2.   Connect the Unidrive control I/O to the required configuration. E.g. Flexible or Fixed Duty, and the number of starters to be controlled. Refer to section 3.3.

3.   If Flexible duty is required check that all electrical and Mechanical interlocks are functioning correctly.

4.   Ensure the Enable input, terminal 30 is open circuit and switch on power to the Unidrive. The LED display should indicate the drive is in a inhibit state 'inh'.

5.   Check to ensure the correct application and system software versions are installed. If the files are not installed or the versions are incorrect, download the correct files using Control Techniques 'Win-flasher' software.

6.   Default the Duty-Assist application parameter in Menus 18–20 by setting parameter 19.24 = 1. Note: this will automatically reset to 0 when all parameters have been defaulted.

7. Select the required terminal allocation by setting parameter 19.25 to one of the following: -

   0 = No selection. User must define all control parameter mappings.

   1 = Unidrive I/O only, this will control up to 2 starters only.

   2 = Unidrive I/O & additional I/O, this will control up to 4 starters.

   When mode 0 is selected refer to the Unidrive user manual for guidance of the configuration of the digital I/O.

8. If terminal allocation mode 1 or 2 is set in parameter 19.25, then check the routing of the digital inputs are correct, by acknowledging the digital states of the following parameters.

Terminal Mode 1 (19.25 =1)

Termina	Terminal Parameter	Description	Application Parameter
24	08.01	Starter 1 Available	19.43
25	08.02	Starter 1 Running	19.44
27	08.04	Starter 2 Available	19.45
28	08.05	Starter 2 Running	19.46
29	08.06	System Run	18.40

Terminal Mode 2 (19.25 = 2)

Termina	Terminal Parameter	Description	Application Parameter
24	08.01	Starter 1 Available	19.43
25	08.02	Starter 1 Running	19.44
27	08.04	System Reset	18.50
28	08.05	System Auto Select	18.41
29	08.06	System Run	18.40
44	16.10	Starter 3 Running	19.46
45	16.11	Starter 4 Available	19.47
46	16.12	Starter 4 Running	19.48
48	16.07	Starter 2 Available	19.49
49	16.08	Starter 2 Running	19.50
50	16.09	Starter 3 Available	19.45

9. Determine if the Start/stop control is to be done locally by Unidrive terminal 29 input, or remotely via serial communication using the controlword. Set 18.42= 1 if remote serial communication control is required.

10. Determine if the each set point and feedback is to be derived to the Unidrive as an analogue signal, or by serial communications. Set the following parameter appropriately: -

Process Set point

18.37 = 0: Set point is written to parameter #18.11 by the Unidrive keypad or by serial communications, in Engineering Units.

18.37 = 1: Set point is set by an analogue signal connected to terminal 7.

Process Feedback

18.38 = 0: Feedback is written to parameter #18.01 by serial communications in Terminal Interface Units.

18.38 = 1: Feedback is set by an analogue signal connected to terminal 5 & 6 differential or 5 single ended (6 connected to 3).

Manual Speed Set point

18.39 = 0: Speed set point is written to parameter #20.21 by the Unidrive keypad or by serial communications in 0.1Hz (fixed Point Integer value).

18.39 = 1: Speed set point is set by an analogue signal connected to terminal 5 & 6 differential or 5 single ended (6 connected to 3). Used in manual mode only.

11. Where analogue signals are set the required analogue signal type; refer to section 3.2.2.

12. Acknowledge the signal/s are present by monitoring the values on the following parameters.

Terminal	Terminal Parameter	Allocation	Application Parameter	Range
5 & 6	07.01	Process feedback	18.01	0 – 4000
7	07.02	Process set point		
8		Thermister		
51	16.04	Speed ref.1		
52	16.05	Speed ref.2		

The terminal input parameter will indicate 0-100.0, which corresponds to 0 to full range of signal.

13. Set the feedback scaling for working with real engineering units.

Refer to section 6.2.3. Example set ups are shown below: -

e.g.1. Local analogue feedback

A pressure transducer has a working range of 2-10bar the set point and control resolution is to 0.01bar. The scaling parameters are set as follows: -

18.12 = 1000   - EGU High (fixed point integer to 2 decimal places and is equivalent to 10.00bar)

18.13 = 4000   - TIU High, (Default max analogue 1 range value that corresponds to the Max EGU value)

18.14 = 200   - EGU Low (fixed point integer to 2 decimal places and is equivalent to 2.00bar)

18.15 = 0   - TIU Low, (Default min analogue 1 range value that corresponds to the Min EGU value)

e.g.1. Remote analogue feedback derived over serial Communications.

The pressure feedback signal is derived as value between the ranges of 0 – 1023, which corresponds to 2 -10bar. The set point

and control resolution is to 0.01bar. The scaling parameters are set as follows: -

18.12 = 1000   - EGU High (fixed point integer to 2 decimal places and is equivalent to 10.00bar)

18.13 = 1023   - TIU High, (Max range value corresponding to the Max EGU value)

18.14 = 200   - EGU Low (fixed point integer to 2 decimal places and is equivalent to 2.00bar)

18.15 = 0   - TIU min, (Min range value corresponding to the Min EGU value)

14. Check the selected Process set point (18.03) and feedback (18.02) parameters are indicating the correct values in the defined Engineering units range. This can be achieved by varying the set point and feedback source between the min and max range.

15. Select the required Duty-Assist control Mode in parameter 19.29 to one of the following: -

   1 = Fixed Duty, with 4 assist starter selected by order of a set Sequence.

   2 = Duty rotated, with 3-assist starter selected by order of a set Sequence.

   3 = Fixed Duty, with 4 assist starter selected by order of Runtime.

   4 = Duty rotated, with 3-assist starter selected by order of Runtime.

16. Set the Number of Motors to be controlled in parameter 19.30. If one of the fixed duty modes is selected, (e.g. 19.29 = 1 or 3), then the motor being controlled by the Unidrive is to be excluded.

17. When one of the Sequence modes is selected, (e.g. 19.29 = 1 or 2), then set the sequence order in parameter 19.19. This parameter will restrict the entry of duplicate starter numbers. The starting order is always from the most significant digit and vice versa for stopping. This is applicable to any number of starters used. E.g. if 3 starters are used, it is important to ensure the first 3 MSD's values correspond to the starters required to be controlled.

18. Before running the process in closed loop, the sequencing/selection of each starter can be checked, by applying a manual speed reference and using the default thresholds and time delays. This is described in the following points.

19. Set to Manual mode: -

Terminal Mode (19.25)	Remote Mode (18.42)	Action to select Manual Mode
2	0 or 1	Open contact on input to terminal 28
0 or 1	0	Set parameter 18.41=0.
0 or 1	1	Set bit4 to 0 of control word parameter 73.70

20. Enable the drive by closing enable input on terminal 30, and also if Remote mode is selected, set bit0 of control word parameter 70.70. The drive should display 'rdy' on the LED keypad.

21. Run the system by: -

Termina Mode (19.25)	Remote Mode (18.42)	Action to Run System
1 or 2	0	Closing contact on terminal 29
0	0	Set parameter 18.40=1
0, 1, 2	1	Set bit1 to 1 of control word parameter 73.70

With fixed duty mode the drive should immediately go to a run state. The drive keypad should display 'run'.

Flexible duty mode the Unidrive will go to a run state approximately 2 seconds after the Duty starter contactor has been selected.

NOTE

The user must make sure that all the relevant valves & dampers are open to ensure no system overpressures and damage to the pump/fan can occur, before running.

22. Apply a manual speed reference by: -

Termina Mode (19.25)	Analogue Enable (18.39)	Action to set Manual Speed reference.
Any	1	Varying the analogue signal on terminal 7.
Any	0	Setting the required speed on parameter 20.21 in 0.1Hz.

23. Increase the speed so it exceeds the assist start threshold set in parameter 18.20. After the start time delay has elapsed, set in parameter 18.21, the first assist starter will be selected. Adjust the start threshold & delay if required. If the speed set point remains above the start threshold, then after a time delay set in the transition delay parameter 19.18 the next assist starter will be selected. This will continue until all assist starters are running.

Check!

Sequence mode (18.29 = 1 or 2) – Ensure each starter is selected in order detailed by parameter 19.19, (most significant digit is the first starter to be selected.

Runtime mode (18.29 = 3 or 4) – Ensure each starter is selected in order of the least number or of runtime hours.

24. When the speed is reduced below the assist start threshold the assist starters should remain on, until the speed reference is reduced below the assist stop threshold, set in parameter 18.22, one of the running assist starters will be stopped, after the stop time delay has elapsed, set in parameter 18.23. Adjust the stop

threshold & delay if required. If the speed set point remains below the stop threshold, then after a time delay set in the transition delay parameter 19.18, the next assist starter will be selected to stop. This will continue until all assist starters are stopped.

Check!

Sequence mode (18.29 = 1 or 2) – Ensure each starter is deselected in order detailed by parameter 19.19, (least significant digit is the first starter to be deselected.

Runtime mode (18.29 = 3 or 4) – Ensure each starter is deselected in order of the most number or of runtime hours.

For more information on the start/stop thresholds refer to section 6.6.

25. To set-up the overall stopping functionality for the system, set the speed reference above the start threshold again, allow all starter to be selected, as detailed in point 21. To stop the system select one of the following methods: -

    i. **Controlled Stop**, by disabling the System Run, the assist starters will be stopped to one of the methods detailed below: -

- *Cascade stop*: each assist starter is stopped individually in sequence to a predefined delay set in parameter 20.22. When all the assist starters have stopped the Duty Unidrive will ramp down a to stop.

- *Normal crash stop*: all assist starters are stop together after the duty drive is ramped down to a stop.

    ii. **Crash Inhibit stop**, by disabling the Enable input, all starters and the Unidrive are stopped altogether. The Unidrive will free wheel, uncontrolled to a stop and instantaneously be set to an inhibit state, 'inh'.

26. The system is now ready to be set up in Automatic (PID) mode. Ensure the system is stopped and select 'Auto' Mode as follows: -

Terminal Mode (19.25)	Remote Mode (18.42)	Action to select Manual Mode
2	0 or 1	Close contact on input to terminal 28
0 or 1	0	Set parameter 18.41=1.
0 or 1	1	Set bit 4 to 1 of control word, parameter 73.70

27. Determine the speed profile required for the process and set Inverse speed profile parameter 18.31 accordingly.

E.g. *does the speed of the duty motor vary proportionally or inversely proportionally to the process error?* Refer to section

6.3.10 for more details. The following table are speed profile with respect to typical processes and is to be used as guidance only.

Process	Speed Profile	18.31
Pressure Supply	Inverse	1
Temperature Cooling Tower	Proportional	0
Aeration tank	Inverse	1
Level Tank/reservoir supply	Inverse	1
Level Tank/reservoir discharge	Proportional	0

28. Ensure the following features are disabled.

Feature	Parameter
Override Enable	18.32=0
Sleep Enable	18.33 = 0
Process Alarms	18.35 = 0
No Flow Protection	18.36 = 0
Cycle Enable	18.49 = 0
Starts per Hour protection	19.31 = 0
CTIU Watchdog Enable	20.37=0

29. Set the ramp rates on the drive, parameters 2.11 and 2.21, to suit the load and the process. (the ramp rates are set in sec/100Hz).

NOTE:

Setting the ramps will have an effect with the overall tuning of the system, as the ramps are a lagging component in the forward path. It is advisable to ensure the ramp rates are kept to a minimum for dynamic responsive processes like pressure control and extended, if required, for longer process times like temperature.

30. Set the PID gains to the following:

Gain	Equivalent Setting	Parameter
Proportional	1	18.17=1000
Integral	0	18.18 = 0
Differential	0	18.19 = 0

Only setting the P term will enable the system to run with minimum instability, but to derive a speed set point from the PID there will have to be a steady state process error.

31. Set process set point so a positive error would be generated. This can be found by comparing the selected process set-point (18.03) with the feedback (18.02), or by looking at the process error parameter (18.05). Note the process error parameter 18.05 will not display the error value until the system is started unless the PID

---

always enabled parameter (18.44) is set to 1. Apply process set point as follows: -

Terminal Mode (19.25)	Analogue Enable (18.37)	Action to set Manual Speed reference.
1 or 2	1	Varying the analogue signal on terminal 7.
0	0	Setting the required set point on parameter 18.11 in EGU.

32. Enable and run the Duty drive.

33. The Duty drive will ramp to the speed set in parameter 1.21. This is derived from the output of the PID as follows:

01.21 = 20.24 / (20.20 * 10)

Where:

01.21 = Preset speed reference parameter

20.24 = PID scaled output parameter

20.20 = PID output scalar parameter (default 1)

With only the Proportional gain set the speed set point is proportional to the error as follows: -

Speed setpoint(01.21) = (error(18.05) * Pgain(18.17)) / (20.20 * 1000 * 10)

34. Adjust the process set point so the output of the PID/speed setpoint is not saturated to the Max or Min speed of the drive. Ensure it is lying between these values and also not exceeding the start or stop thresholds.

35. There will be a Process error present in parameter 18.05, to reduce this increase the integral gain, parameter 18.18, until the error is zero.

36. To complete the tuning of the PID, a stepped reference is required to ensure the PID loop reacts correctly for the process, increasing, or decreasing the process set point can achieve this.

Monitor the duty speed overshoot and steady state error and adjust the gains to ensure minimum error and overshoot. Refer to section 6.3.2 for more information.

37. Once satisfied with the gain settings, adjust the Process set point so the assist starters are started and stopped. Monitor the system response and adjust PID gains if required. A process error will occur when an assist starter is started or stopped (e.g. process stepped change), if the gains are set correctly the Duty drive should reacted effectively to reduce the error, with minimal overshoot and delay.

38. A slew limit can be used to reduce the rate of change on the process set point, adjusting parameter 18.16. This may help with tuning on start up and large changes of process set points.

39. This completes the getting started procedure. This has covered the majority of the commissioning for the Duty-Assist application software. For set-up of the optional features refer to the relevant functional description in section 6.

40. To save & retain parameter values during power off perform the following procedures: -

    i. Ensure the system is stopped.

    ii. Menus 0 to 19

- Enter 1000 to any parameter XX.00
- Preset 'Reset' button

    iii. Menu 20

- Enter 1 to parameter 17.19. The value should automatically reset to 0, if save was successfully completed.

5.3 Commissioning Sequence

Commission UniDrive & Motor, ensuring motor maps and protection are configured   Refer to the VTC Udive Documentation

↓

Check mechcanical and Electrical interlock for each starter.   Refer to sections 3.4 & 3.5

↓

Check digital and Analogue I/O are correctly connected to Unidrive. Configure Analogue signal types and digital logic   Refer to section 3.

↓

Set the mode of operation and the number of assist starters to be controlled.   Refer to section 5.7

↓

Test out system in manual Speed mode to ensure correct switching of Assist starters. Set thresholds and delays accordingly.   Refer to section 5.6

Configure the scaling into Real Engineering Units and select suitable range   Refer to section 5.2.2

↓

Configure speed profile required & run system in Auto mode. Tune the PID gains for the process .   Refer to section 5.3

↓

Configure optional functions if required: Sleep, Cycle starters, Process alarms, No Flow and SPH protection   Refer to Sections 5.8 to 5.12

↓

↓

6 Functional Description

6.1 Overview

The diagram below illustrates the Duty-Assist application broken down into individual functions, where some are mandatory for the software to operate correctly and others are optional. The purpose for the optional functions is to reduce the requirement for addition external periphery, therefore help to save time and money with system integration.

Duty Assist Control Block Diagram
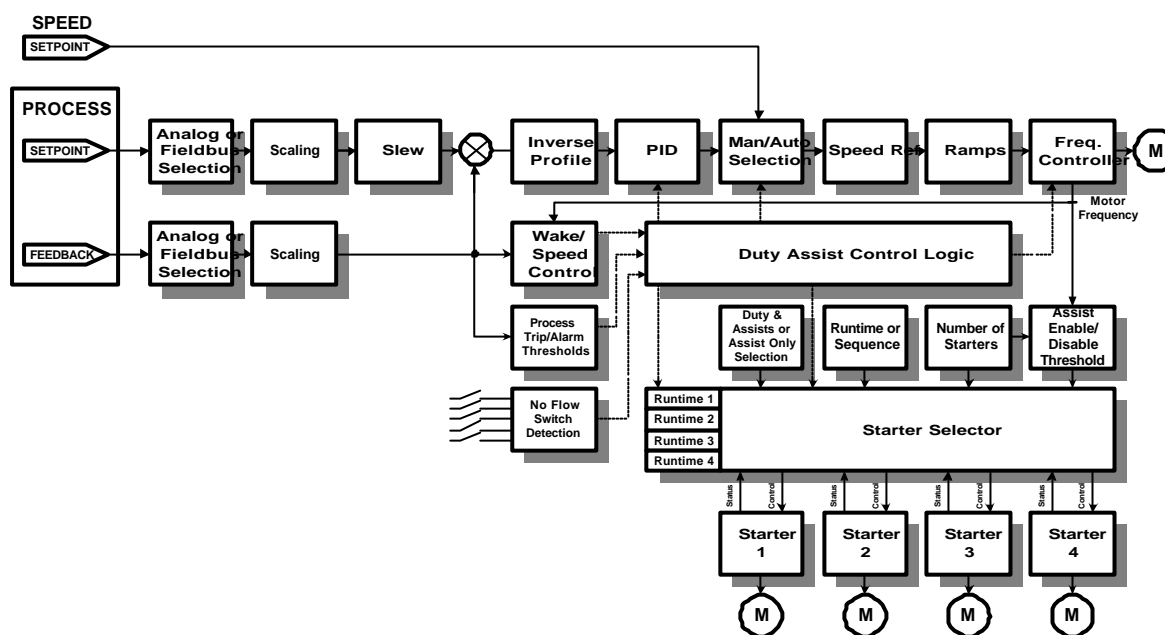
The Control Techniques Duty-Assist software has 4 operational modes, which are follows: -

1. Fixed Variable speed Duty with up to 4 Assist Starters selected by a predefined sequence.

2. Flexible Variable speed Duty selection with up to 3 Assist Starters selected by a predefined sequence.

3. Fixed Variable speed Duty with up to 4 Assist Starters selected by a their runtime.

4. Flexible Variable speed Duty selection with up to 3 Assist Starters selected by a their runtime.

6.2 Set-point/Feedback Scaling & Selection

SETPOINT & FEEDBACK SCALING AND SELECTION

Process Setpoint

91.09

**Analogue 2
Term 7.**

Fbk TIU High
18.13

X

$\dfrac{1}{1000}$

SCALING

Fbk TIU High(X2) 18.13	Fbk EGU High(Y2) 18.12
Fbk TIU Low(X1) 18.15	Fbk EGU Low(Y1) 18.14

1

Parameter
Process Preset
Setpoint 1
18.11

0

Fbk EGU High
18.12

Fbk EGU Low
18.14

Parameter
Process Preset
Setpoint 2
20.42

1

0

18.03

**Process
Setpoint
(EGU)**

Process Setpoint
Preset 2 Select
18.32

Process Setpoint
Analog Select
18.37

Process Feedback

91.08

**Analogue 1
Terms 5&6.**

1

Parameter
Feedback
18.01

0

SCALING

Fbk TIU High(X2) 18.13	Fbk EGU High(Y2) 18.12
Fbk TIU Low(X1) 18.15	Fbk EGU Low(Y1) 18.14

18.02

**Process
Feedback
(EGU)**

Feedback
Analogue Select
18.38

Speed Setpoint

91.09

**Analogue 2
Term 7.**

Max Speed
01.06

X

$\dfrac{1}{1000}$

Max Speed
01.06

Parameter
Speed Setpoint
20.21

Min Speed
01.07

1

0

18.04

**Speed
Setpoint
(0.1Hz)**

Speed Setpoint
Analog Select
18.39

6.2.1 Terminal or Parameter Selection

The source for each the process feedback & set point, and speed set point can be selected from the Unidrive analogue terminals or direct from a parameter. The parameter selection enables the values to be set directly from the keypad or written to via serial communications. A combination of terminal and parameter sources can be configured as each set point/feedback has its own unique selection parameter as detailed in the following table: -

Set point/Reference	Selection Parameter	Source
Process Set point	18.37 = 0	Parameter 18.11
	18.37 = 1	Terminal 7
Process Feedback	18.38 = 0	Parameter 18.01
	18.38 = 1	Terminal 5 & 6
Speed Set point	18.39 = 0	Parameter 20.21
	18.39 = 1	Terminal 7

NOTE:

Process set point & and speed set point share the same analogue input as they are only operational in one of the control modes Auto or Manual.

The standard analogue terminal allocations are not user configurable. Selecting the 'Parameter' source for set point/feedback is the only method of reconfiguring the analogue source. The required analogue input can then be mapped and scaled accordingly from the standard Unidrive parameters (Menu 7 or 16).

For information on the analogue input signal types that can be connected to the Unidrive refer to section 3.2.1. .

6.2.2 Parameter Process Preset Set-points

Two different preset set points can be selected when in parameter mode, (18.37=1). This can be used to alternate the Process set point for two separate conditions. E.g. Day & Nigh, (High & Low) Duty conditions. The preset set points are selected between the main parameter set point (18.11) and the preset set point 2 parameter (20 .42) by the preset set point 2 select parameter (18.32).

NOTE:

The Unidrive and the application module do not support a real-time clock, therefore to achieve a Day/Night set point selection an external device (with real time clock) is require to control the preset set point 2 select parameter (18.32) either via a Unidrive terminal, mapped to the parameter or via serial communications using the control word, bit 9.

6.2.3 Real Engineering Units and Scaling

With a linear feedback transducer, two known points on the feedback graph must be defined. Two known real pressure points should be entered, along with the feedback value into the drive for each point. This allows two equations to be derived that allow the feedback values

from the transducer in Terminal Interface Units (TIU), to be converted to real EnGineering Units (EGU), and vice versa.
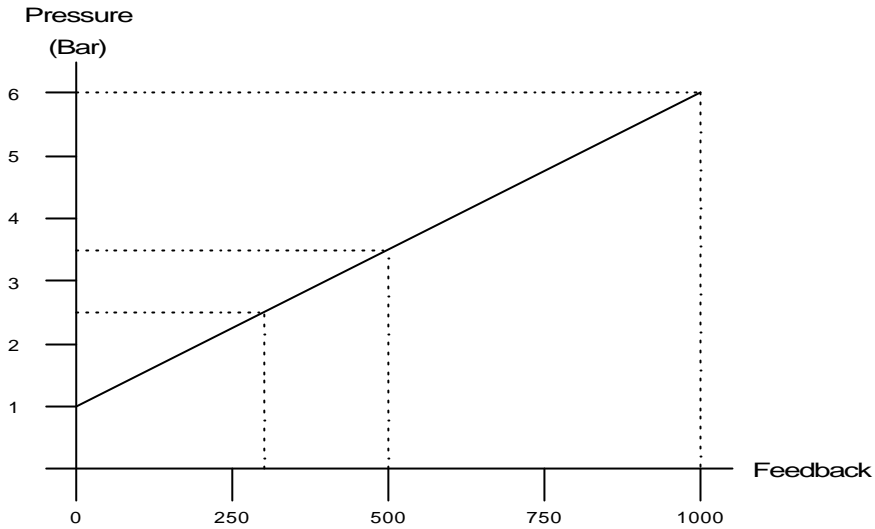
Typically, the defined points will be the maximum (20mA) and minimum points (4mA), but this does not have to be the case. Any two points will provide the necessary information.

When a trip threshold is specified, it would be specified as "4.78 bar". The specified data to convert the above graph would be:

Minimum Point: Maximum Point:

Feedback TIU Low(18.15) = 0 Feedback TIU High (18.13) = 1000
Feedback EGU Low(18.14) = 1 Feedback EGU High (18.12) = 6

There is a slight problem with the above figures. When the fixed points are defined, decimal places are not available with the drive parameters. Therefore, in the above example, the resolution on the real pressure parameters is 1 bar, with no points in between. The scaled feedback value will only resolve to 1 bar, with no resolution for points in between, and the same will apply to the maximum and minimum thresholds. Therefore, only 4 bar or 5 bar can be set as the maximum pressure.
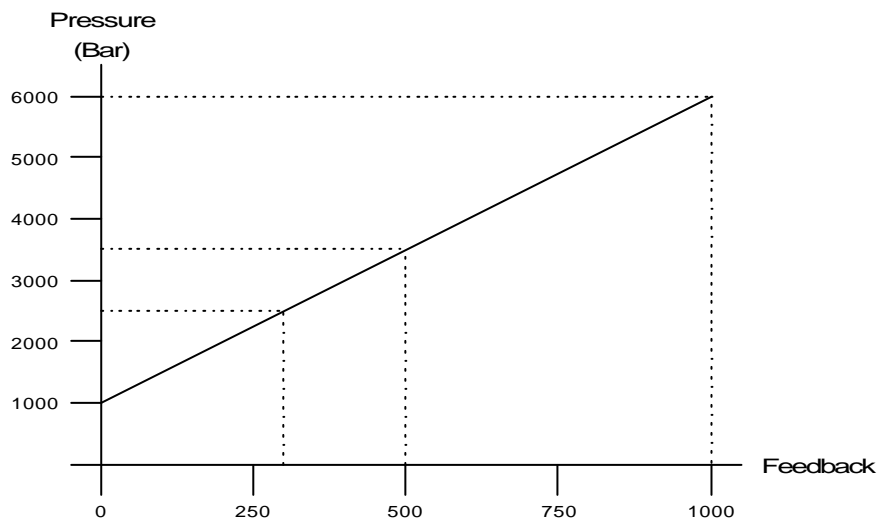
To increase the resolution, fixed-point maths needs to be used. To set the real pressure in units of milli-bar, let 1000 = 1 bar. Values returned from the equation derived will therefore * 1000, providing an effective resolution of three decimal places. The specified data to convert the above graph would now be:

Minimum Point: **Maximum Point:**

Feedback TIU Low(18.15) =0   Feedback TIU High (18.13)=1000

Feedback EGU Low(18.14)=1000Feedback EGU High (18.12)=6000

The trip threshold specified, as "4.78 bar" would now be entered as milli-bar, so a value of 478 would be entered. This would be converted to transducer units as 756, or 75.6% feedback.

6.3 PID Controller

6.3.1 PID Description

The PID, (Proportional-Integral-Derivative) provides closed loop regulation to maintain process consistency and compensate for any external disturbances. Example uses are for temperature, flow, pressure, level, etc

PID Controller

```
                                           Max Clamp Limit
                                           Max Speed * Output Scalar
                                           01.06 * 10 * 20.20

        Inverse Profile                                              To Auto/Man
        18.31                          Proportional                  Selection
                                       18.17
          -1   1      Slew Rate    +   Integral                      20.24
                      18.16            18.18
   18.03       0                   -   Differential                  PID Output
                             18.05                                   SCALED
   Process                   Process
   Setpoint                  Error
   (EGU)                     (EGU)

          -1   1                                    Min Clamp Limit
                                                    Min Speed * Output Scalar
   18.02       0                                    01.07 * 10 * 20.20

   Process
   Feedback
   (EGU)

              Duty Running
              10.02
                            &
              Auto Selected
              18.41
                                  |
              PID Enable
              18.44
```

6.3.2 PID Operation

The Process set point (18.03) represents the demanded value to be reached, and the Process feedback (18.02) is the current, actual value being read from the process transducer. The set point and the feedback are compared and the difference between these values is known as the process error (18.05). The process error is used to derive a speed set point to the motor to force the Process feedback to equal the Process set point. The response & the regulation accuracy of the process is dependant on the PID gain setting.

The rate of change of the process set point can be limited by the slew rate (18.16). This is useful to limit the system overshoot when the set point is changed.

6.3.3 Proportional Gain Kp

The Proportional gain is the instantaneous amplification factor that is applied to the process error.

$$Pout = Kp \cdot \varepsilon$$

The Proportional term must have an error to produce an output. The magnitude of the output is dependant on the magnitude of the error and the amount of proportional gain.

Proportional Gain

K - Denotes the Value of Parameter 20.20.
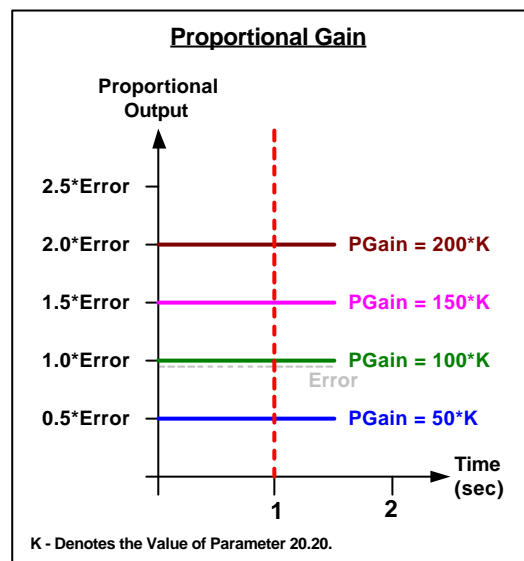
For a process error of 1, and a Proportional gain of 100, the output of the P term will be 1 (0.1Hz). The Gain is set as a fixed-point integer.

When the PID output scalar is set greater than 1, then for the same output with the given error, the gain must be multiplied by the PID output scalar value. Refer to the PID Output scalar section 6.3.7.

6.3.4 Integral Gain Ki

The integral gain is amplification factor of the error over time.

$$I_{out} = (K_I . \int \varepsilon . \delta t) / 10$$

The integral term accumulates any error over time to help reduce any offset or long-term errors. Ki is a multiplication co-efficient of the integrated value.

Integral Gain

K - Denotes the Value of Parameter 20.20
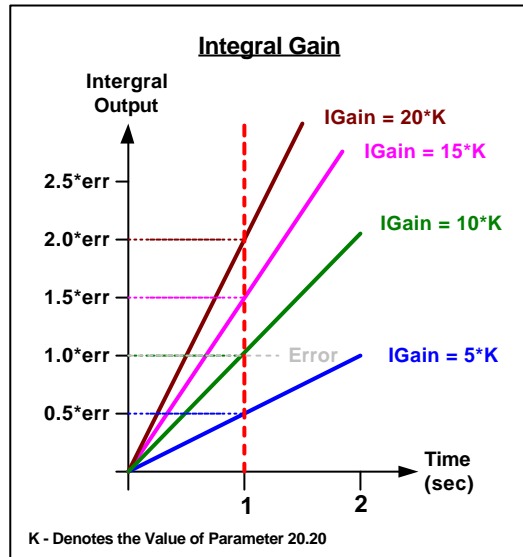
For a constant error of 1, and an Integral gain of 10, the output of the Iterm will reach 1 (0.1Hz) after 1 second. The Gain is set as a fixed-point integer.

When the PID output scalar is set greater than 1, then for the same output with the given error, the gain must be multiplied by the PID output scalar value. Refer to the PID Output scalar section 6.3.7 .

6.3.5 Differential Gain Kd

The derivative gain is amplification factor of the rate of change of error.

$$D_{out} = (K_d \cdot \delta\varepsilon/\delta t) / 10$$

The Differential term is the rate of change of the error multiplied by the Kp co-efficient. This is responsive during transient conditions; therefore it is zero during steady state condition. It is useful to reduce the overshoot during large disturbances. The differential gain is rarely used in most applications as it will amplify any unwanted noise to the system and can cause instability.
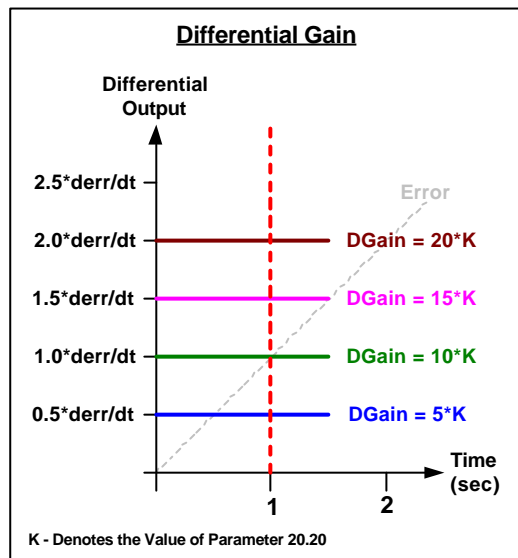
For a constant rate of change of error of 1 unit per second and a differential gain of 10, the output of the D term will be 1 (0.1Hz). The Gain is set as a fixed-point integer.

When the PID output scalar is set greater than 1, then for the same output with the given error, the gain must be multiplied by the PID output scalar value. Refer to the PID Output scalar section 6.3.7.

6.3.6 PID Output

The PID output is the summation of all the terms above as follows: -

$$\text{PID}_{output} = \begin{bmatrix} \overline{} \text{ Max Limit = (Max Speed * K)} \\ \left(\frac{Kp}{100} \bullet error \right) + \left(\frac{Ki}{10} \bullet \int error \bullet dt \right) + \left(\frac{Kd}{10} \bullet \frac{derror}{dt} \right) \\ \underline{} \text{ Min Limit = (Min Speed * K)} \end{bmatrix}$$

The PID output is clamped between two limits, which are the Min and Max frequency settings of the Unidrive (01.07 & 01.06 respectively), multiplied by PID Output Scalar (20.20). These limits define a working area within the PID. If the output crosses one of the limits, the PID output will be clamped until the output returns within these limits. The limits will also stop the integrator accumulating until the integrated error is back in the working range.

6.3.7 PID Output Scalar

The PID output scalar, (K) enables the PID gains to have different operating ranges with their settings, as the table below details: -

Notes:

Each gain parameter range is limited to 0 - +32000.

The speed set point range, (Output of the PID 20.24) is displayed as a fixed-point integer value e.g. 500 = 50.0. The max set point resolution is to 0.1Hz.

PID Scalar	1	10	100
Speed Set point	0 - 500	0 - 500	0 – 500
PID Output	0 - 500	0 - 5000	0 – 50000
P Gain Range	0 – 320.00	0 – 32.000	0 – 3.2000
I & D Gain Range	0 – 3200.0	0 – 320.00	0 – 32.000

This scalar is provided suit the required gain setting range of the process and it is more beneficial for the integrator and derivative gains. The following examples demonstrate this with integral gain: -

With the PID scalar set to 1 and a steady state error of 1, The rate of integrator time range that can be set is: -

Max: 3200 units step in a second or 320.0hz in 1 second (Shortest Time)

Min: 0.1 unit step in a second or 0.1Hz in 10 seconds (Longest time)

With the PID scalar set to 10 and a steady state error of 1, The rate of integrator time range that can be set is: -

Max: 320 units step in a second or 32.0hz in 1 second (Shortest Time)

Min: 0.01 unit step in a second or 0.1Hz in 100 seconds (Longest time)

6.3.8 Transient Response

If a step change was set on the input of the PID the Process can react in the following manner, which is dependant on the setting on the PID gains.
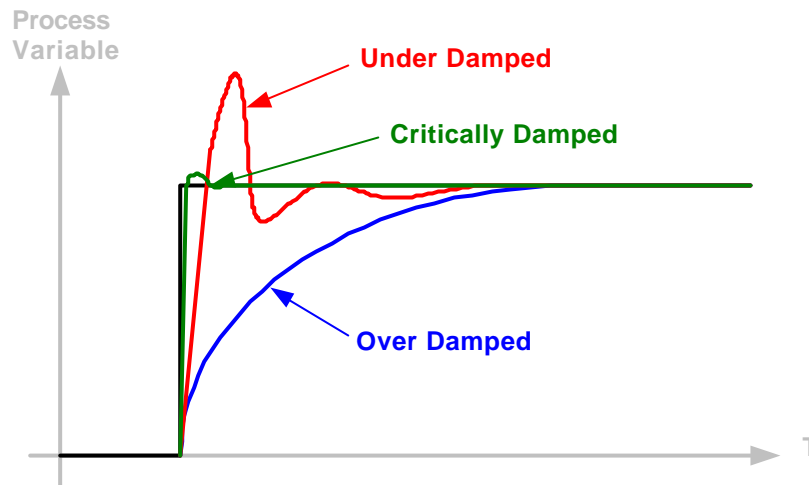
The PID should gains should be set, (or tuned) to ensure the Process has a 'critically damped' response.

6.3.9 PID Control

The PID can be selected to be operation all the time or it can be disabled when it is not running in Auto operation. This operation is determined by the setting of the PID enable parameter (18.44).

6.3.10 Inverse Speed Profile

This feature determines the PID output speed profile with respect to the process error, below are two typical application examples, which demonstrate this feature.

Pressure Control – (Inverse Speed Profile 18.31 =1).
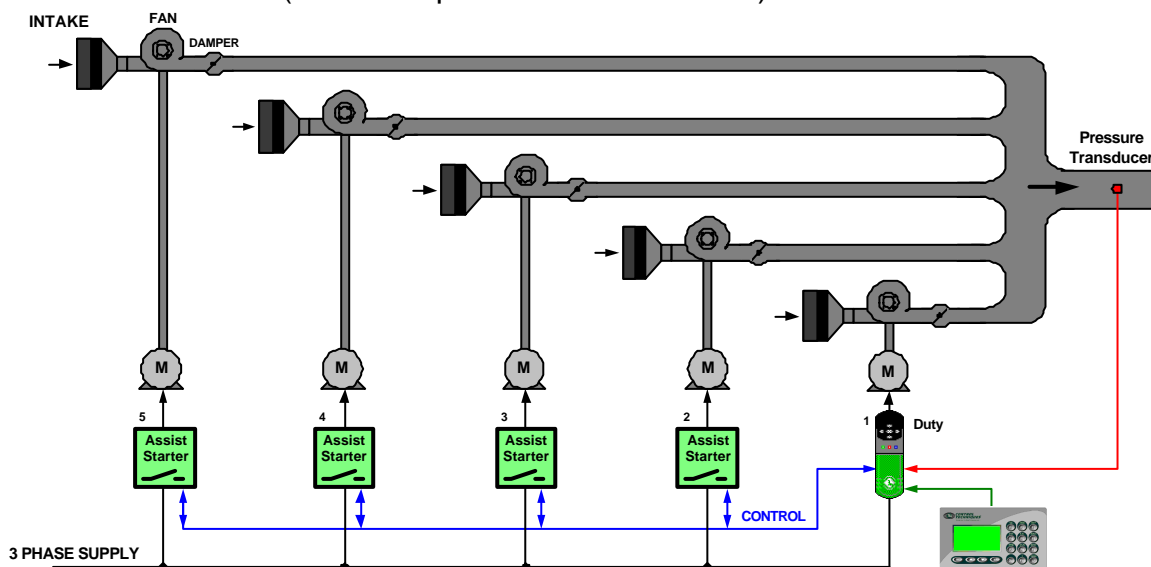
This system will regulate a constant pressure where the speed demand for the inverter should vary inversely proportional to the system process error, e.g. Pressure increases the inverter speed decreases, and vice versa, as shown below: -
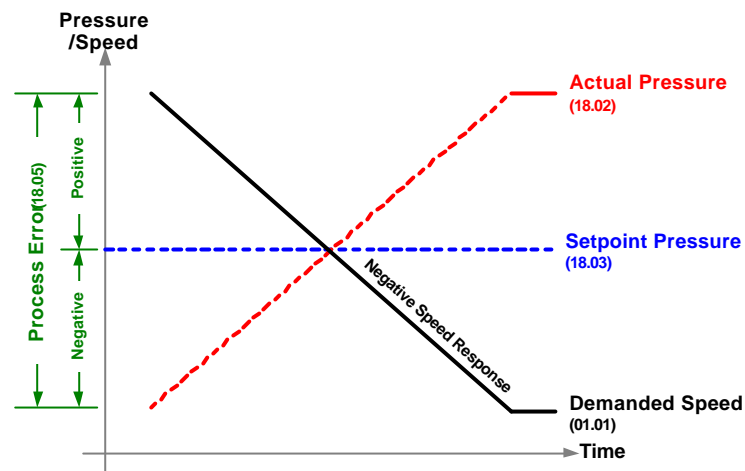
Level Control with Discharge Pump – (Proportional Speed Profile 18.31 =0)
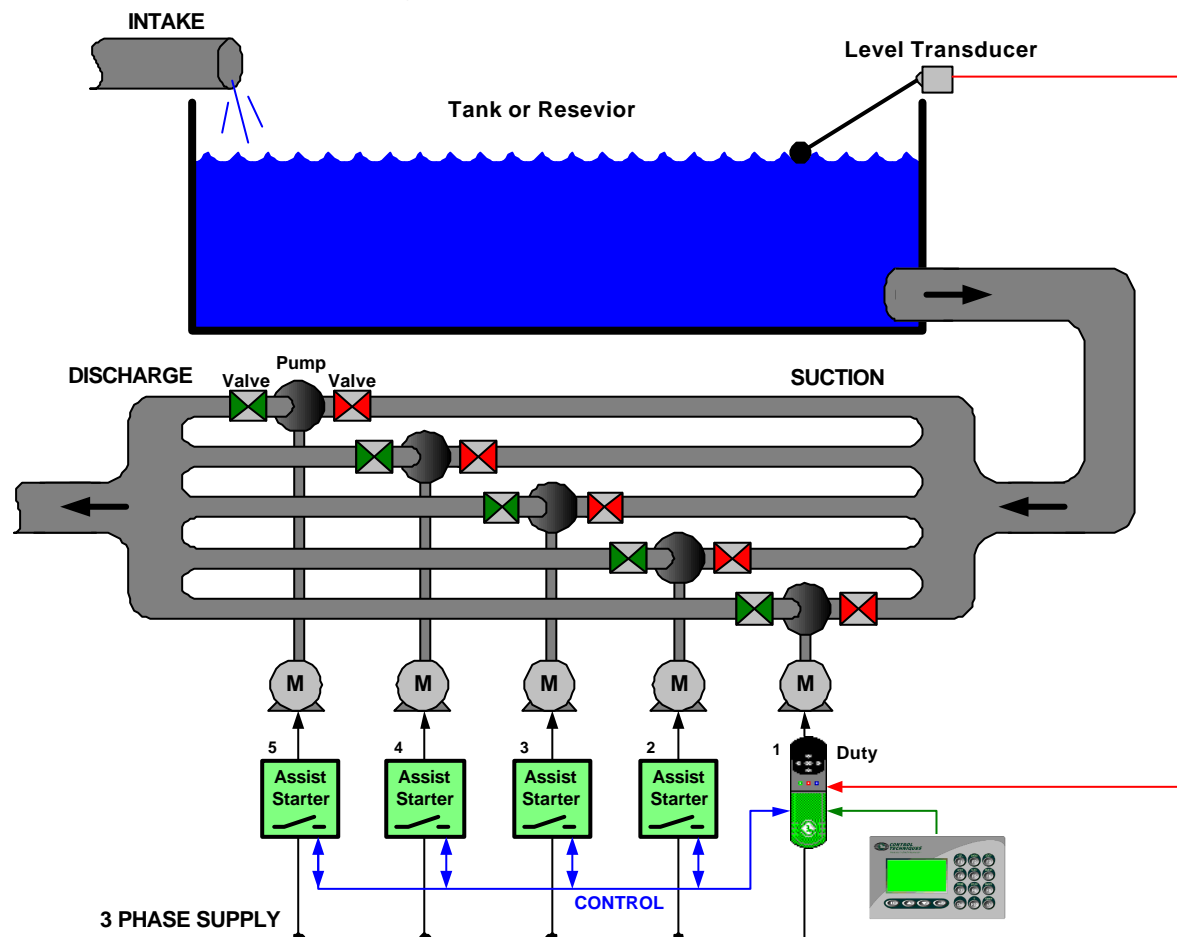
This system will regulate a constant level where the speed demand for the inverter should vary proportionally to the system process error, e.g. Level increases, the inverter speed also increases, and vice versa.
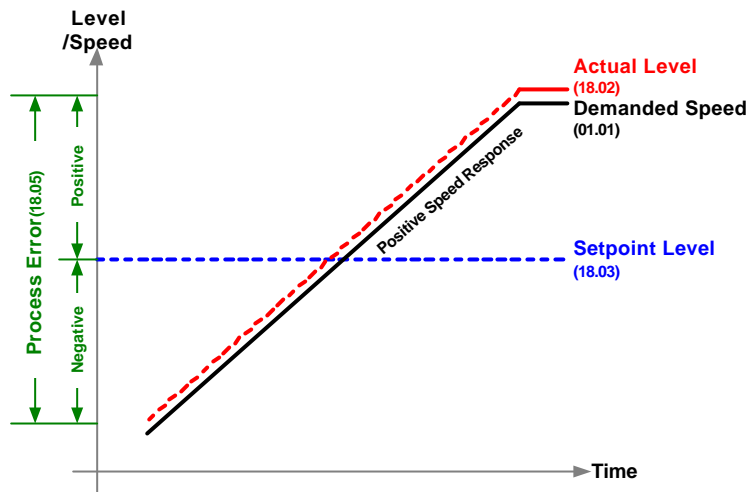
6.4   Auto/Manual Selection
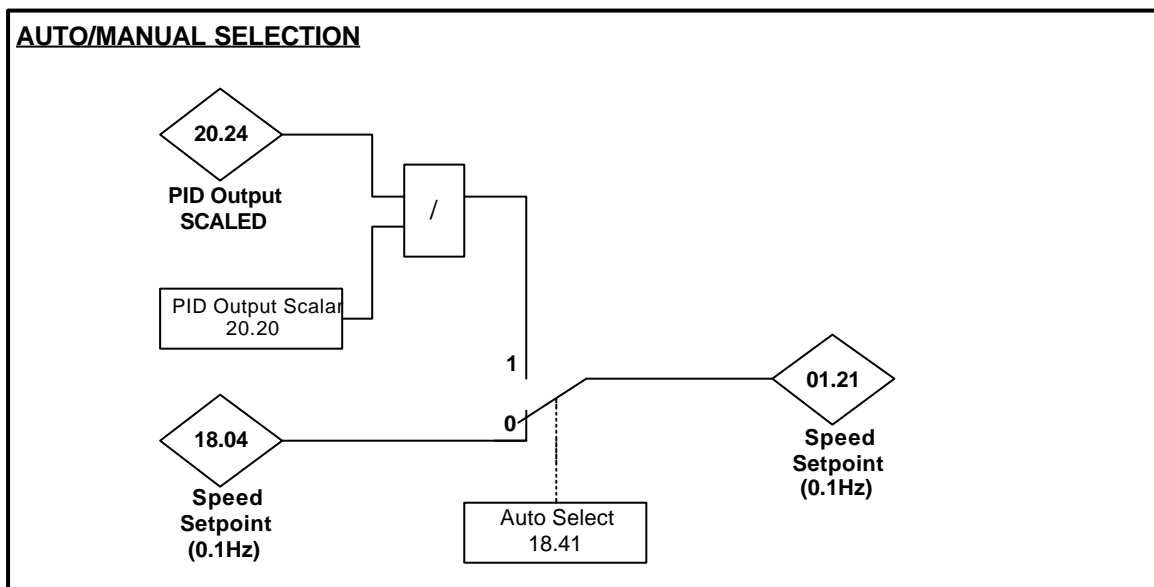
The speed reference to the Duty drive can be derived from one of two sources: -

1.   Manual - A direct speed reference. Refer to section 6.2 for speed set point selection.

This mode can be used to: -

- Run process open loop for tests or emergency situations.
- Checkout the assists, start and stop sequencing without any influence of the process feedback. (Care must be taken not to exceed process limits).
- Accept speed signal derived from an external PID controller as the assist call control and protection logic is still active and available.

Sleep function is not available in this mode.

2. Auto - The speed is derived from the resultant output of the inbuilt PID function, which is dependant on the process error and the gains set. The selection is determined by the Auto select parameter 18.40.

6.5 System Start/Stop Control Logic

System Start/Stop Control

Control Mode 18.29

1 or 3

System Stopped
##.##

= 1
0

Assist Rotation Select
##.##

Drive Healthy
10.01

Drive Running
10.02

HW Enable
08.07

Sleep
##.##

SW Enable
06.15

System Run
18.40

Cascade Stop
18.43

Starter Cycle
18.49

Duty or Assist Control and Sequence Logic

Drive Run
06.30

Duty Starter Enable
##.##

Starter 1 Duty Selected
##.##

Starter 2 Duty Selected
##.##

Starter 3 Duty Selected
##.##

Drive Trip
Duty Contactor Opened while running
TR84

Starter 4 Duty Selected
##.##

Cascade Stop Request
##.##

System Stop
##.##

##.## - Denotes internal variable and no visible parameter is assigned.

6.5.1 Fixed Duty Mode

With the Duty drive available the system can be started & stopped.

The NORMAL STOP mode will ramp down the duty drive first and stopped. On acknowledgement of duty drive stop all starters will be disabled.

The CASCADE STOP will stop each starter in order determined by mode set (Runtime or sequence). The Duty drive will be the last starter to be stopped.

The starters can also be stopped automatically if Cycle or the Sleep functions are selected, but the system will remain enabled. (Please refer to the Sleep and Cycle function for more details).

The SLEEP Function is active when this feature is enabled and the Duty is the only starter running.

The CYCLE Function is active when this feature is enabled and not all starters are running in one of the runtime modes.

Fixed Duty - Flexible Assist Starters
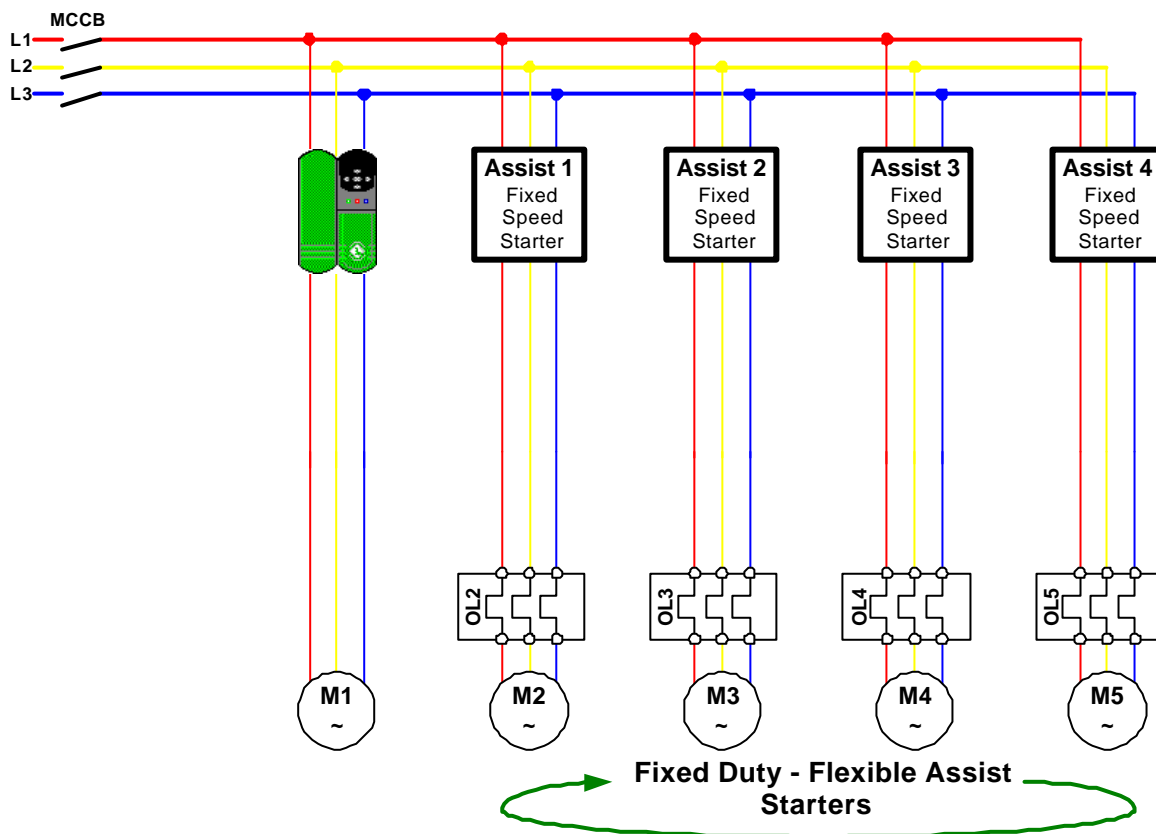
6.5.2 Flexible Duty Mode

The flexible duty system logic operation is slightly different to the fixed duty system logic, as the drive output contactor for the selected motor is required to be controlled.

With the Duty drive available and the run is closed the Duty output contactor is selected, (from lowest runtime or first in sequence).

On acknowledgment of the contactor being closed the drive is started after 2 seconds has elapsed. This is to ensure there is sufficient time for the contactor to close.

Stopping the system is done in the reverse order the drive is stopped first and 2 seconds after the selected output contactor is opened.

The NORMAL STOP mode will ramp down the Duty drive first and stop. On acknowledgement of drive stop all starter will be disabled and the duty output contactor will be opened after 2 seconds has elapsed.

The CASCADE STOP will stop each starter in order determined by mode set (runtime or sequence), the Duty drive will be the last starter to be stopped. When the drive has ramped to zero and stopped and the output contactor will be opened when 2 seconds has elapsed.

The drive will trip 'TR84' if the Duty output contactor opens during operation.

The duty motor/output contactor is selected by: -

- Available and Not already running
- Mode - runtime or the order of sequence

The starters can be stopped if Cycle or the Sleep functions are selected, but the system will remain enabled. (Please refer to the Sleep and Cycle function for more details).

The SLEEP Function is active when this feature is enabled and the Duty is the only starter running.

The CYCLE Function is active when this feature is enabled and not all starters are running in one of the runtime modes.

MCCB

L1
L2
L3

Assist 1	Assist 2	Assist 3	Assist 4
Fixed Speed Starter	Fixed Speed Starter	Fixed Speed Starter	Fixed Speed Starter

CON1/2   CON3/4   CON5/6   CON7/8

OL1   OL2   OL3   OL4

M 1
~

M 2
~

M 3
~

M 4
~

Duty Rotation
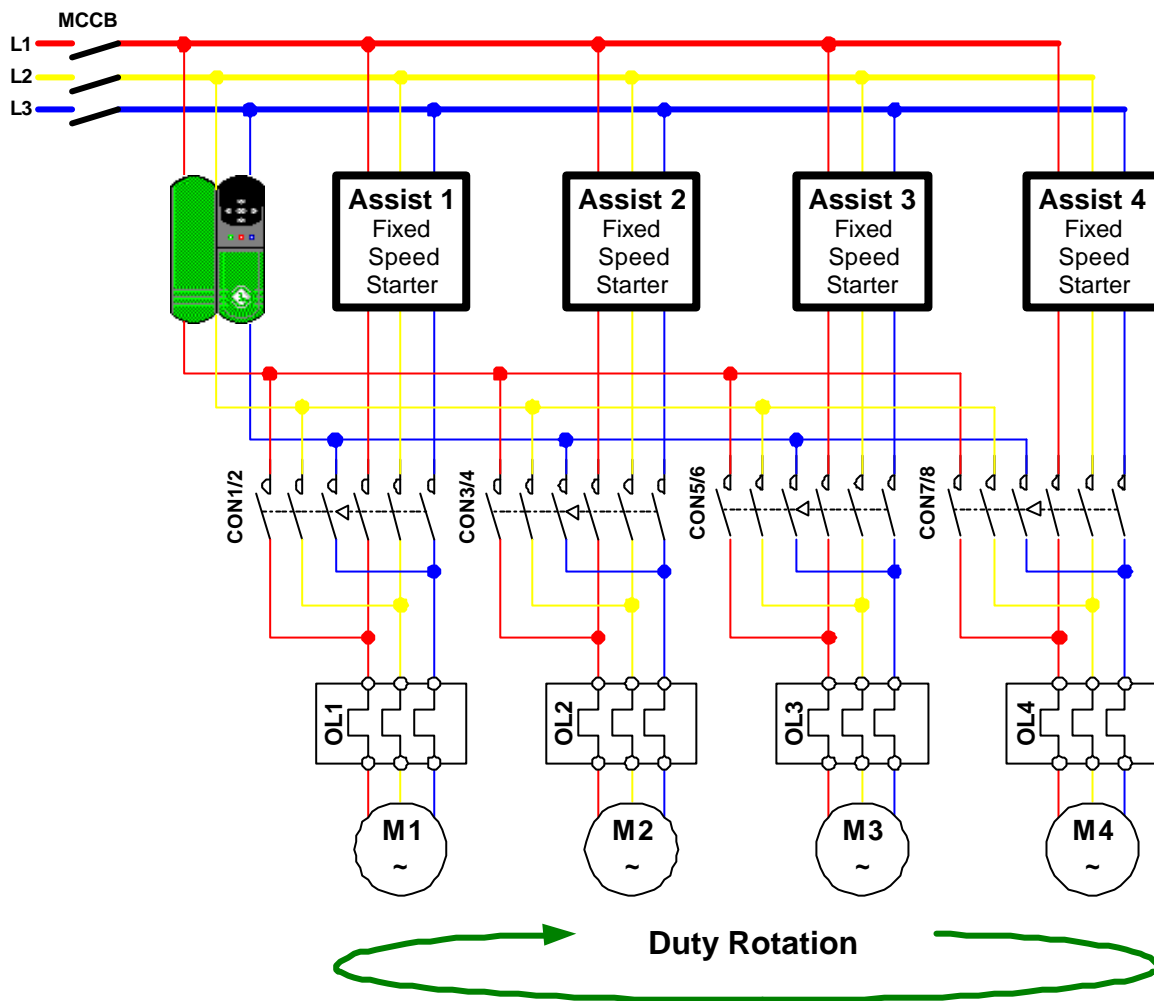
6.6   Assist Start/Stop
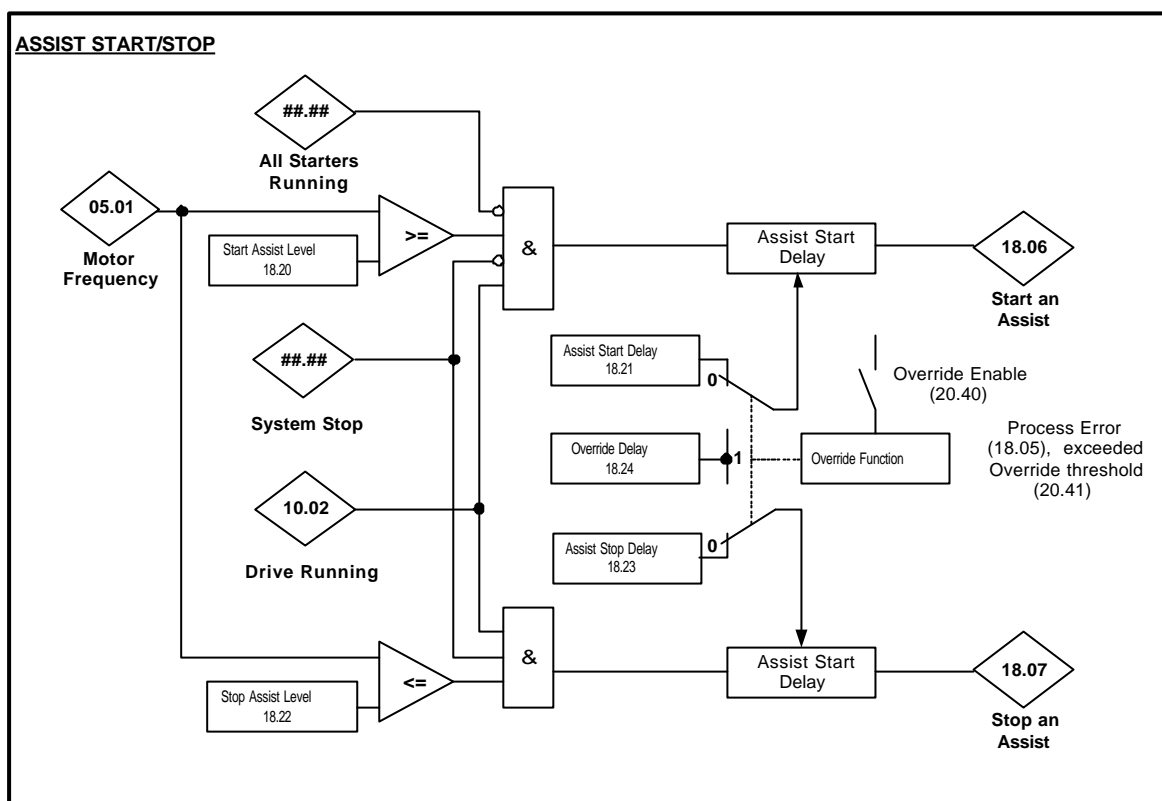
##.## - Denotes internal variable and no visible parameter is assigned.

The Duty drive will always be running within the system as long as there is a process demand. If the demand exceeds the capacity of the Duty then an assist starter will be requested to start, to help to meet the required demand. If the demand reduces below the duty supply capacity, then the Duty will request an assist starter to stop.

The threshold for the Assist start/stop are set with respect to the Duty Speed as this is a good indication of Duty flow capacity, (e.g. Speed is proportional to flow). Typically the Assist Start/Stop thresholds are set to variable Duty working speed range (60-100% or 30 to 50Hz). To ensure there are no spurious start/stopping of the Assist, Start/Stop time delays are available.
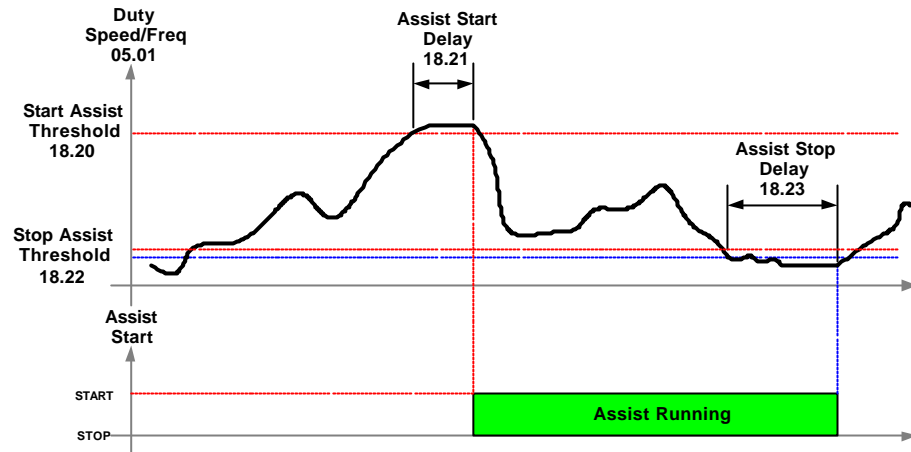
Effect of the Duty control when the Assist Started & Stopped

The following simply explains a Duty-Assist system controlling pressure.

When the duty is at maximum speed for a predetermined time period the assist will be commanded to start. The assist motor will quickly accelerated to full speed and the delivery pressure will also increase corresponding ly. If the process set point is exceeded the Duty speed will be reduced by the PID controller to compensate for this increase.

When the assist is stopped, while the Duty is at minimum speed for a predetermined time, the delivery pressure will decrease correspondingly, therefore if the delivery falls below the demanded set point the Duty speed will increase by the PID controller to compensate for this decrease.
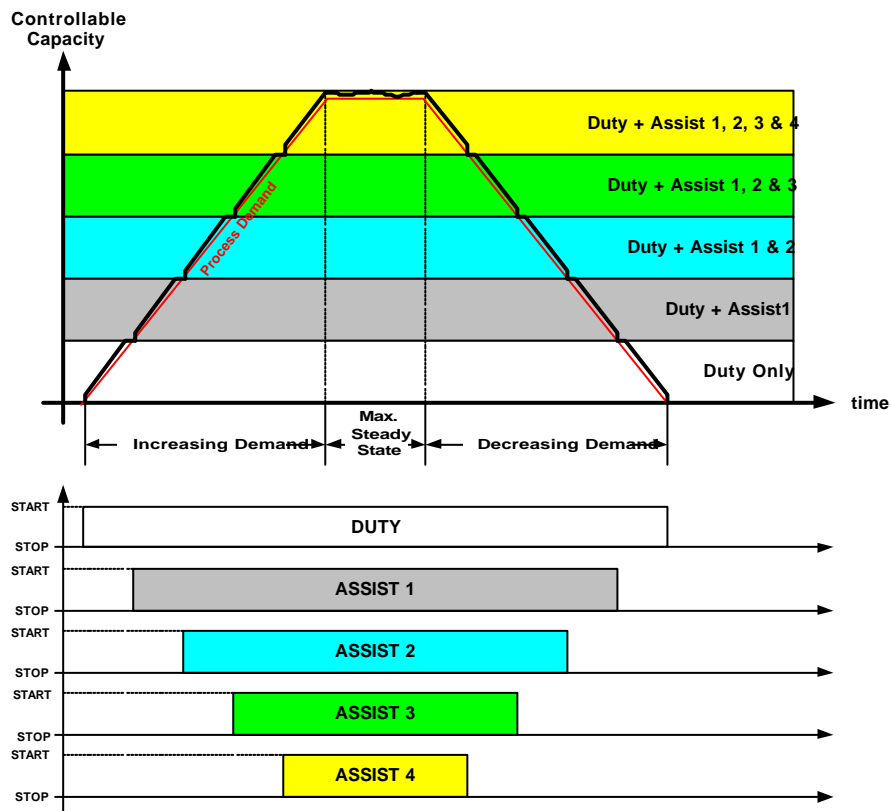
6.6.1 Assist Start/Stop Override.

In some cases during the day or week there may occur a peak loading on the system, where it may be required for the system to react a lot quicker to meet the demand. For this requirement a shorter start/stop time delay can be introduced by enabling the override function (20.40).

The override function operates by setting a symmetrical threshold (20.41), around the process error, if exceeded the override delay (18.24) is used instead of the normal start/stop delays defined in parameters (18.21 & 18.23 respectively). The override thresholds should be set with some margin outside the normal operating region of the process error.
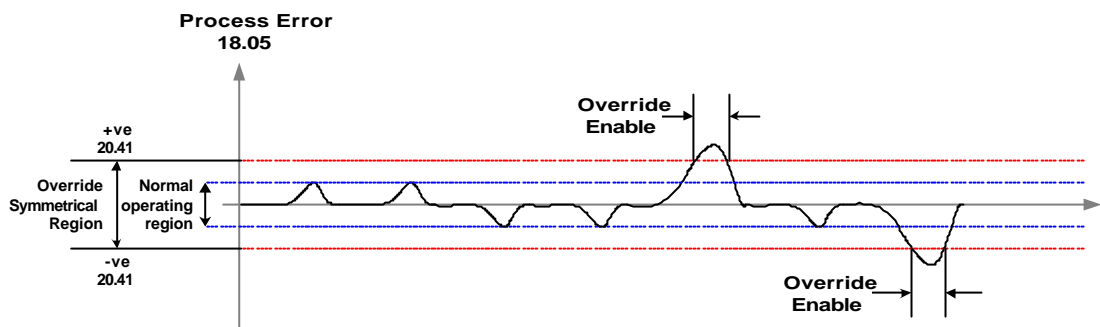
Note: This does not override the transition delay (19.18).

CAUTION

Set the override level with some margin, within the max error band and outside the normal operating region. This will ensure no spurious switching between normal and override delay selection. It is advisable to configure this feature once the system is running satisfactory in Auto mode, (PID) and the start/stop level have been correctly set.

6.7 Assist Selection
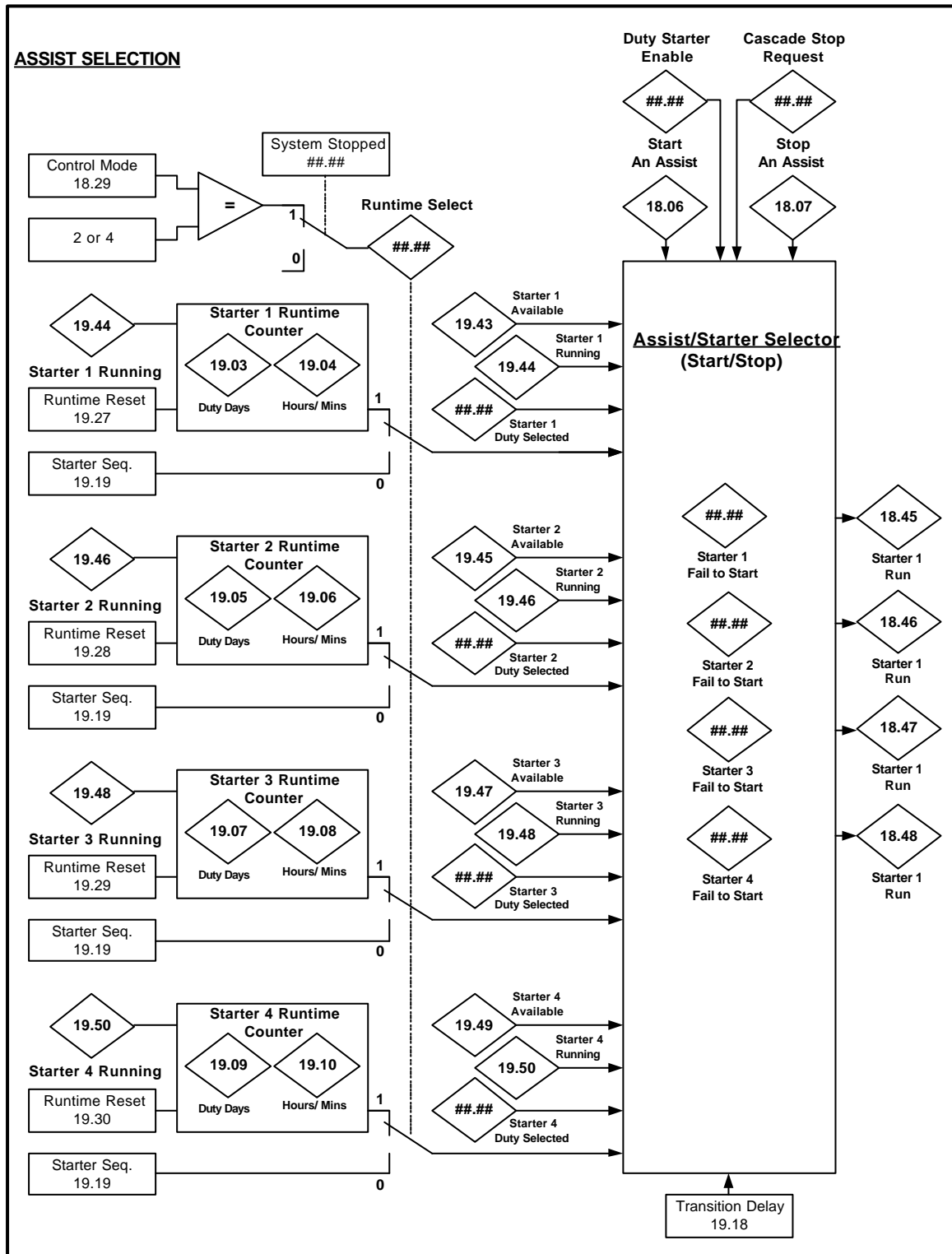
##.## - Denotes internal variable and no visible parameter is assigned.

6.7.1 Assist Selection Description

This function determines which starter is to be selected, for start or stop. The selection is determined on the following criteria: -

Selecting Starter to Start

1. Start request.
    a. Assistance required to help meet process demand, refer to previous section 6.6.
    b. Initial Duty starter selection when a start is commanded. Only applicable in flexible duty modes 2 and 4 are used (18.29)
2. Starter must be stopped, (e.g. not already selected or running in manual mode when a mode selector switch is used on each starter
3. Available to start, (e.g. Healthy, no trip interlocks and in Auto mode when a mode selector switch is used on each starter).
4. Sequence or Runtime.

Selecting Starter to Stop

1. Stop request.
    a. Assistance not required to help meet process demand, refer to previous section 6.6.
    b. Duty starter stop when a stop is commanded. The duty cannot be stopped until all assist starters have stopped. Only applicable when flexible duty modes 2 and 4 are used (18.29)
2. Starter must be running.
3. Available to stop, (e.g. In Auto mode when a mode selector switch is used on each starter).
4. Sequence or Runtime.

6.7.2   Sequence Selection

Each starter is selected in a predefined order set by the user in parameter 19.19. The most to the least significant digit defines the order of each starter to be selected to start, and in the reverse order for stopping, for example: -

Starting:

Most significant Digit is the first starter be selected to start and the least significant digit is the last.

Stopping:

Least significant Digit is the first starter be selected to stop and the most significant digit is the last.

This is applicable to any number of starters used. E.g. if 3 starters are used, (parameter 18.30 = 3), it is important to ensure the first 3 digits, from most significant digit (digit 4), values correspond to the starters required to be controlled. The least significant digit (digit 1), will be ignored.

When the selected starter fails to start, or not available or already running then the next starter in the sequential order will be started. When the starter becomes available again then it will be selected when the next assist start is requested.

Most Significant Digit   Most Significant Digit

Digit 4   Digit 1
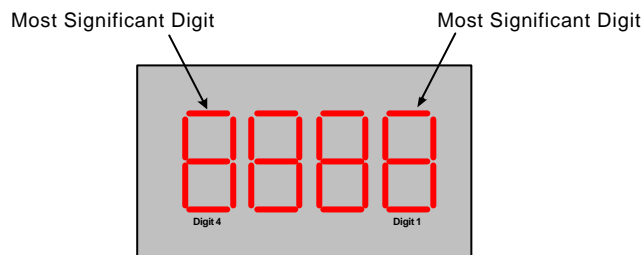
6.7.3   Runtime Selection

Each starter is selected by the number of run time hours. The order of starting will begin with the starter with the less runtime hours commencing to the starter with the most. The order of stopping will begin with the starter running with the most runtime hours commencing to the starter with the least.

When the selected starter fails to start, or not available or already running then the next starter with the lowest runtime will be started. When the starter becomes available again then it will be selected when the next assist start is requested.

6.7.4   Transitional Delay

The transitional delay, parameter 19.18 defines the delay for the next starter to be started or stopped if the start/stop request remains high. This may occur due to the process demand not being satisfied with the original requested starter, (e.g. starter Failed to start or more capacity required). This delay should be set to allow enough time for the assist to have an effect on the system, (for the Assist start/stop request to go low), This will therefore guard against premature starting of assists starters in slow reacting loads, like temperature or level control processes.

6.7.5   Assist Fail to Start

When an assist starter fails to start on selection, due to a loose wire etc, within the transitional delay time, the starter will be lock out to enable another assist starter to start. To enable the failed starter to be available for reselected, the system reset is required to be performed. This is achievable by following methods: -

1. Terminal 2 mode is selected (19.25 =1), closed input on term 27.

2. No terminal allocation, set parameter 18.50 = 1.

3. Serial communications, set bit 6 of the control word parameter 73.70.

Indication of the assist starters, in order of failure is displayed in parameter 19.22. Bit parameter 19.32, a global assist starter fail-to-start flag, is set when any of the starters have failed.

                         Issue Number: 1

6.8   Wake/Sleep Function
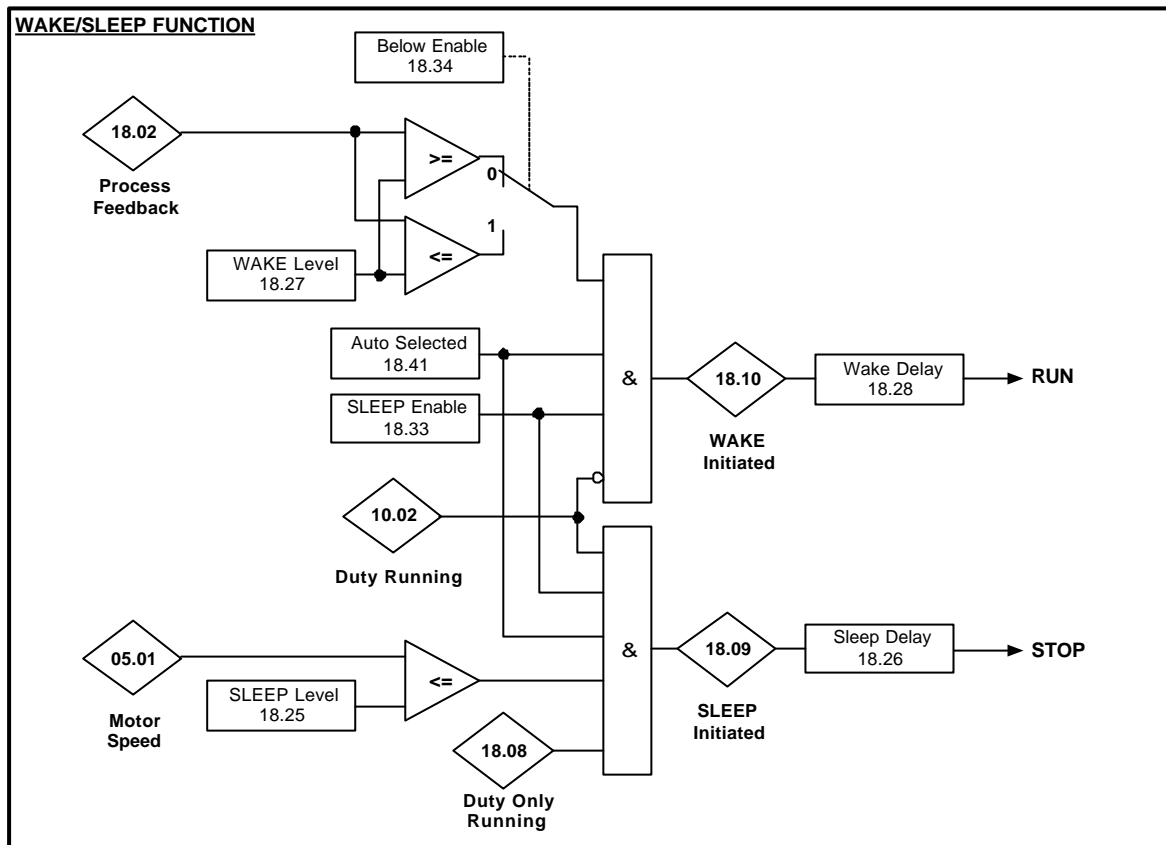
When the variable speed demand on a centrifugal type load is less than 40% the system load power is negligible, due to the power being proportional to the cube of speed. The majority of the power derived to system at low speeds is supporting the system static losses (e.g. Inverter, motor, pump, gearbox, etc), though this power loss is small in comparison to the total load power the annual costs can be quite significant. To help reduce the cost of this waste of power over long periods of time, the controller can sense a speed threshold where the motor is practically running at no load, and switch-off /stop the inverter. The inverter can be switch-on/started again when the system demand increases to a suitable level. This function is known as 'Sleep' and 'Wake' function, where sleep mode is when the inverter switches off and wake mode is when the inverter switched back on line. This function is used in applications with wide controllable ranges or slow process updates like temperature control that have large system time constants.

The Wake/Sleep function is enabled by parameter 18.33 and is only operational when the Duty-Assist system is in 'Auto, mode (18.41=1). To 'Sleep', the duty must be the only starter running and the duty motor frequency must be equal or below the sleep threshold for the duration, that exceeds the sleep time delay. To 'Wake', the duty must not be running, while the process feedback has exceeded the wake threshold for the duration that exceeds the wake time delay.

Process Feedback Value (18.02)

Wake-up Delay (18.28)

Wake-up Threshold (18.27)

T

Motor Frequency (05.01)

Sleep Delay (18.26)

Sleep Threshold (18.25)

T

Unidrive Run Command (06.30)

ON

OFF

T
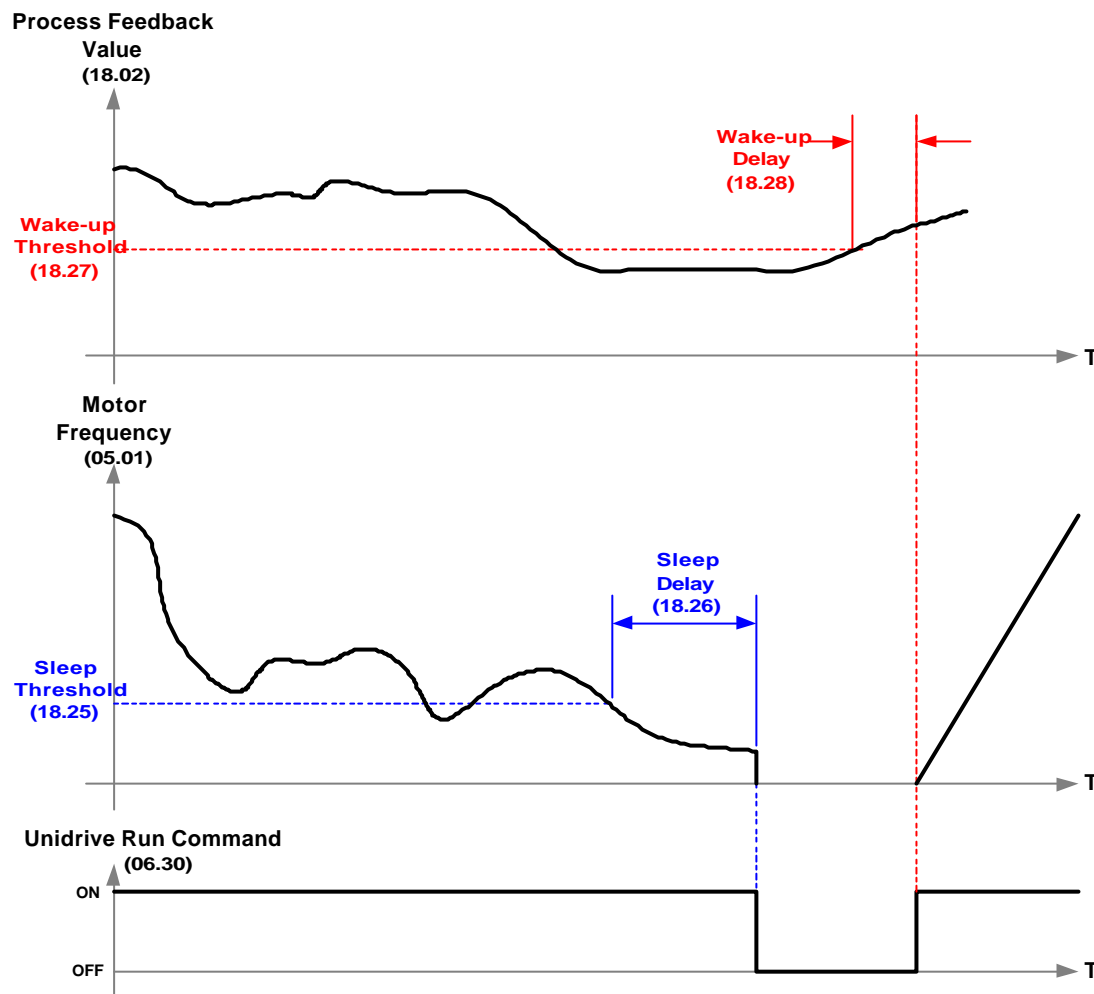
The wake function can be set to start the Duty drive when process feedback is above or below the wake threshold as shown below. This is set dependant on the speed profile set for the process being controlled.

E.g.

1. In processes where the speed increases proportionally with the process feedback, (e.g. Temperature), the duty drive is required to 'sleep' at low speeds, where the process feedback should be below the wake threshold. The drive will 'wake' when the process feedback exceeds, or is above the wake threshold. In this case it is advisable to set the wake threshold ABOVE the process set-point.

2. In processes where the speed increases inversely proportionally with the process feedback, (e.g. Pressure), the duty drive is required to 'sleep' at low speeds, where the process feedback should be above the wake threshold. The drive will 'wake' when the process feedback is 'below' the wake threshold. In this case it is advisable to set the wake threshold BELOW the process set-point.
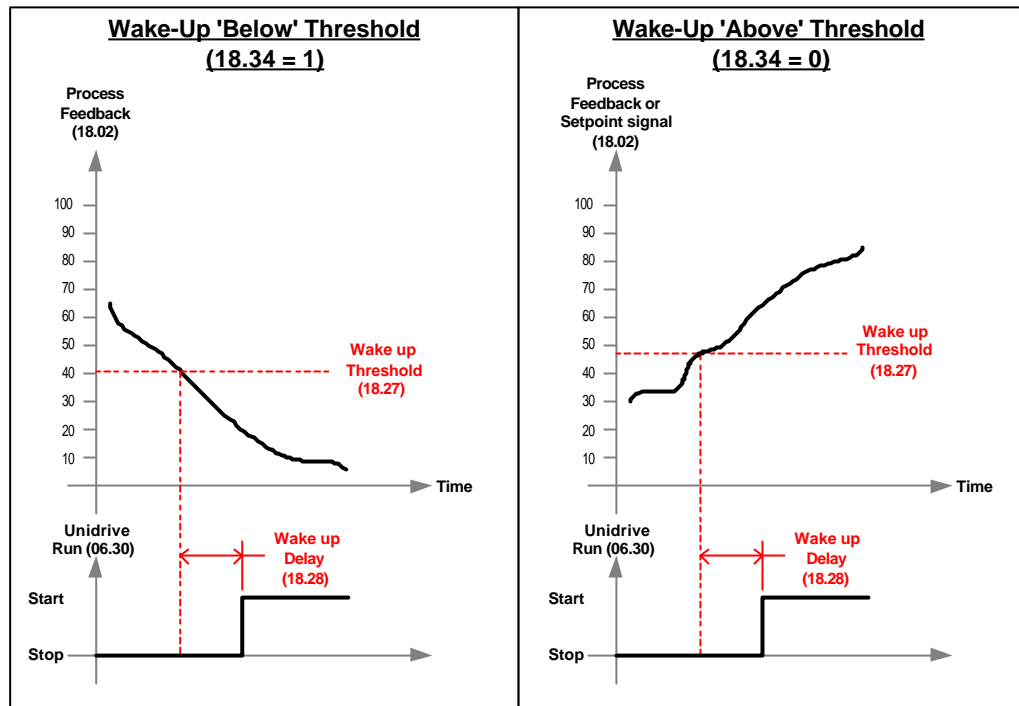
Warning Drive could Start and Stop un-expectantly when this feature is enabled as it is automatically under control of the feedback signal and drive frequency.

6.9   Cycle Starters

The Cycle Function ensures that all the starters are rotated during lengthy operation times, and it is only applicable when operating in one of the runtimes modes, (18.29 = 3 or 4).

Though the assist selection function ensures each assist starter is selected by its runtime when started and stopped, on some occasions the same starters may remain running for lengthy period of time, as these are sufficient to meet the current process demand. Meaning the other starters may not or never get selected. This is common in systems where one or more starters are for standby operation.

Setting the Cycle parameter (18.49 = 1) will stop the system starters, after a predefined time set in parameter 20.23. The system will restart again allowing the starter with lowest runtime to be selected.

This will function is inhibited when all starters are running together.

CAUTION

Drive could Start and Stop un-expectantly when this feature is enabled as it is automatically under control of the feedback signal and drive frequency.

6.10 Process Feedback Alarms
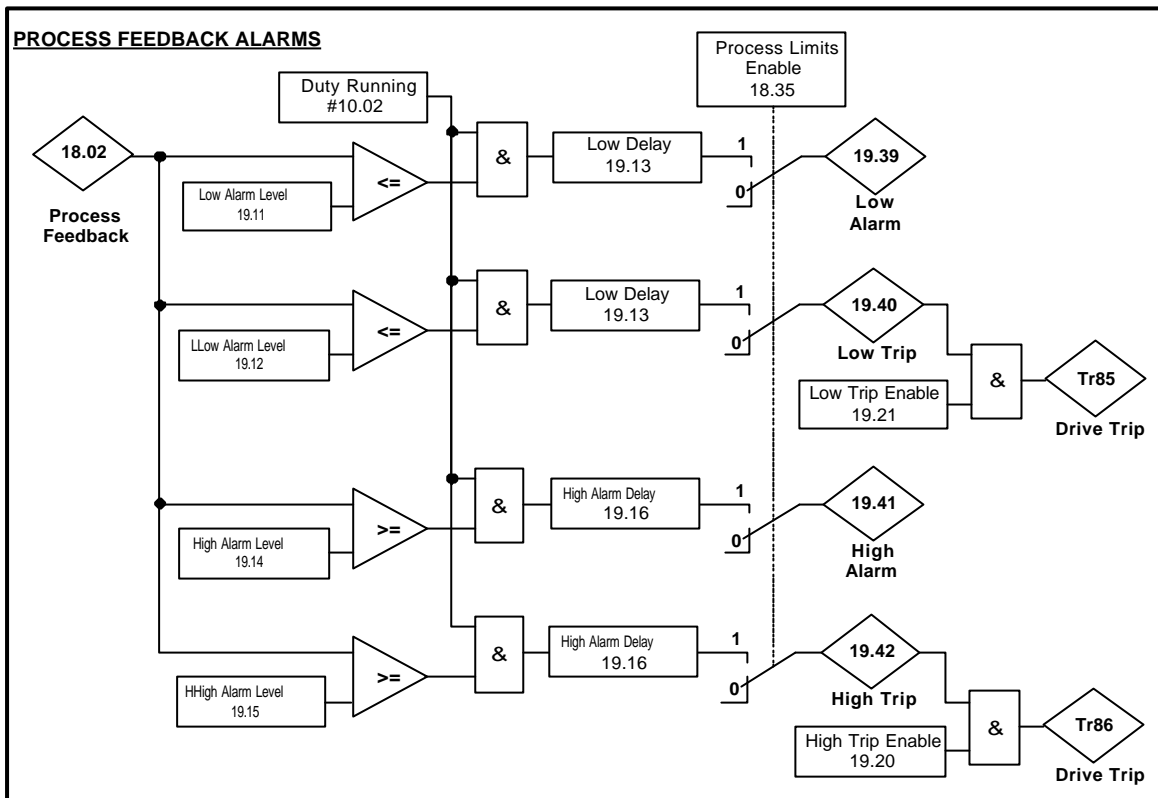
The Process Feedback Alarms provides indication and when required, integrated protection for the process. Four alarms thresholds with respect to the process feedback can be set-up and monitored when the duty drive is running. Two are high alarms, that are set when the process feedback exceeds the thresholds set in 19.14 & 19.15, and two are Low alarms, that are set when the process feedback fall below the thresholds set. Two common alarm delays are available, (Low delay 19.13; High Delay 19.16), to help reduce any spurious tripping or indication.

The High-High and Low-Low alarms can be set to trip the Unidrive/system, (Tr81 or Tr80), when the process feedback is equal or outside these thresholds, (19.20=1 or 19.21=1 respectively). The trips can be reset by the 'System reset'.

6.11   No Flow Protection
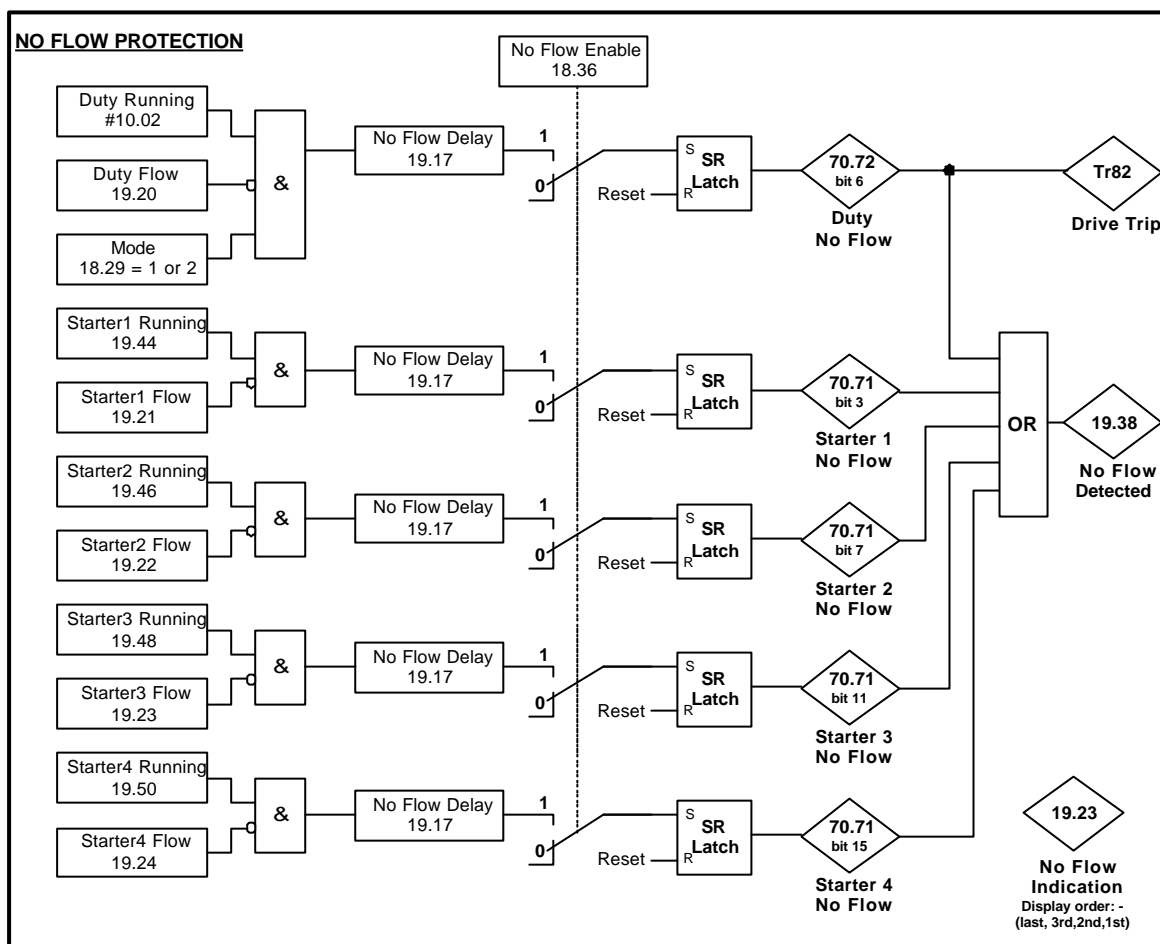
NO FLOW PROTECTION

No flow protection ensures the system or machine, whether it is a Fan or a pump, is not damaged when operational for long durations of time with no flow.

A flow switch mounted on the machine manifold is set to detect/acknowledge minimum allowable flow for the machine. The flow switch is usually a fail-safe contact, closed for flow & open for no flow. The flow protection is monitored when this feature is enabled (18.36=1) and the motor starter is running. A common no flow time delay is used to ensure flow is established. The delay time should be set for the worst case, which is usually dependant on the starter with the longest ramp time to establish flow.

When no flow has been detected on a machine the corresponding starter will be stopped. The starter will be made unavailable to start until a system reset has been performed. Parameter 19.38 when set, indicates a no flow on one or more machine has been detected. Indication of the starters with no flow detected and the order they occurred is displayed in parameter 19.23. The least significant digit is the first and the most significant digit is the last starter with no flow detected.

An independent no flow protection is used for the duty when the mode is selected to any of the two fixed duty modes (18.29 = 1 or 3). If no flow is detected on the fixed duty the drive will trip 'TR82'.

When a no flow is detected on the selected duty motor, operating in Flexible duty mode (18.29 = 2 or 4), each assist starter is stopped in turn, the duty is then ramped down to stop and 2 seconds after the output contactor is opened. A new duty motor is reselected and the duty is ramped back up to speed. The previous duty starter will be locked out from be selected until a system reset is performed.

The No flow inputs can be sourced from local Unidrive inputs or via serial communications. Standard terminal defaults (19.25 = 1 or 2), do not source any of the no flow inputs.

6.12   Number Starts per Hour Protection
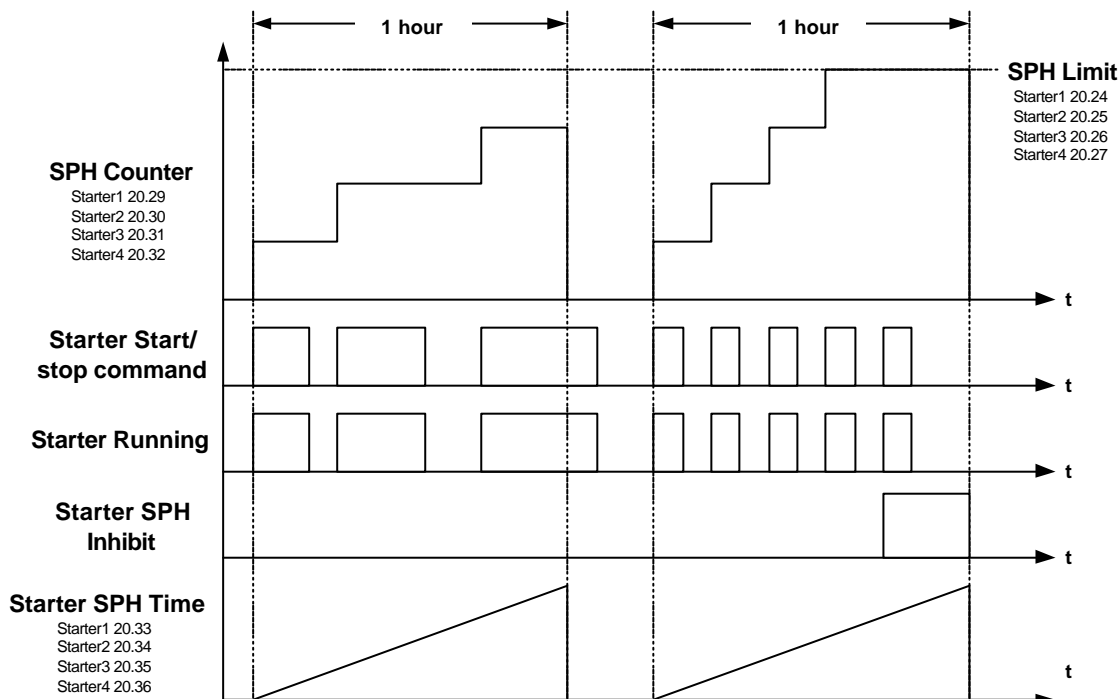
The assist starters in most cases will be fixed speed starters like Direct-On- Line, Soft starter, Auto -Transformer & Star-Delta starters. The motor will be restricted to a limited number of starts per hour due to these fixed speed, starting methods. Consult the motor manufacturers documentation for this information.

The Number of SPH protection function enables the user to limit the number of starts per hour on each fixed speed motor. If the limit is exceeded, the corresponding starter will be inhibited and made unavailable for selection. The starter will be available for selection again when the remaining time left within the hour has elapsed, to allow the motor to cool down.

This protection is only active when the UD70 is powered up and the feature is enabled, parameter 19.31 =1.

Each starter is monitored and a count value is accumulated every time it is started.

The Count value is reset every Hour, which allows the starter to be restarted to the maximum defined limit.

When in Duty Rotation mode the selected Duty motor SPH counter is inhibited, as it is not application for variable speed drives.

NOTE

4. ***Additional Overload protection is required for each fixed speed starter, fuses & Thermal Overloads. These should be adequately rated to provide the primary protection.***

7 Parameter Descriptions

7.1 Unidrive Parameters

The following parameters listed are only relevant to this application (in open loop mode). A short description of the parameter is given but for more information please refer to the Unidrive/VTC manuals.

7.1.1 Saving parameters

To save parameters to Non-volatile memory enter 1000 to any of the XX.00 parameters and press the reset button.

7.1.2 Other Documentation References

Manual Description	CT Part Number
Unidrive VTC User Guide	0461 - 0006
Unidrive User Guide	0460 - 0070
Unidrive Advanced User Guide	0447 - 1001

7.1.3 Menu 1

01.01	Reference selected
Coding	RO, B, P
Range:	±1000.0*
Units:	Hz
Default settings:	

Indication of the reference being used by the drive is given for system set up and fault finding.

01.06	Maximum Frequency Clamp
Coding	RO, B, P
Range:	±1000.0
Units:	Hz
Default settings:	50.0

Defines drive absolute maximum frequency reference.

01.07	Minimum Frequency Clamp
Coding	RO, B, P
Range:	±1000.0
Units:	Hz
Default settings:	0.0

Defines drive absolute minimum frequency reference.

01.10	Bipolar reference select
Coding	RW, B,
Default settings:	0

If the user requires changing the direction of rotation with a bipolar reference, this parameter should be set. If it is not, all negative references are treated as zero.

Application Recommended setting = 3.

01.11	Reference enabled indicator
Coding	RO, Bit, P

The drive sequencer defined in Menu 6 controls this indicator. This is set when commanded to run with the drive enabled and healthy.

01.14	Reference selector
Coding	RW, Uni
Range:	0-5
Default settings:	0

This parameter is used to select a speed reference as follows:

0   Reference selection by terminal input

1   Analogue reference 1 selected

2   Analogue reference 2 selected

3   Preset reference selecte d

4   Keypad reference selected

5   Precision reference selected

Application Recommended setting = 3.

01.15	Preset selector
Coding	RW, Uni
Range:	0-9
Default settings:	0

This parameter is used to select a preset speed reference as follows:

0   Preset selec tion by terminal input

1   Preset 1 selected

2   Preset 2 selected

3   Preset 3 selected

4   Preset 4 selected

5   Preset 5 selected

6   Preset 6 selected

7   Preset 7 selected

8   Preset 8 selected

9   Preset selection by timer

Application Recommended setting = 1.

01.21	Preset Speed reference 1
Coding	RW, Bi
Range:	±1000.0
Units:	Hz
Default settings:	0.0

Preset speed reference 1.

This is the speed reference is derived from the application software within the UD70.

02.01	Post ramp speed reference
Coding	RO, Bi, P
Range:	±1000.0
Units:	Hz

This is the speed reference after the ramps. The range of this parameter is restricted so that it cannot be larger than the range set by Pr 01.06 (maximum speed clamp) and Pr 01.07 (minimum speed clamp).

7.1.4 Menu 2

02.04	Ramp mode
Coding	RW, Txt
Range:	0 – 2
Default settings:	2

This parameter has 3 settings as follows:

0   Stnd.Hd   Standard ramp with ramp hold

1   FASt   Fast ramp

2   Stnd.Ct   Standard ramp with ramp control

The acceleration ramp is not affected by the ramp mode, and the ramp output will rise at the programmed acceleration rate (subject to the current limits programmed in an open loop drive).

Application Recommended setting = 2.

02.10	Acceleration Selector
Coding	RW, Uni
Range:	0 – 9
Default settings:	0

This parameter is used to select acceleration ramp rates as follows:

0   Ramp rate selection by terminal input

1   Ramp rate 1 selected

2   Ramp rate 2 selected

3   Ramp rate 3 selected

4   Ramp rate 4 selected

5   Ramp rate 5 selected

6   Ramp rate 6 selected

7   Ramp rate 7 selected

8   Ramp rate 8 selected

9   Ramp rate selection by preset reference selection

Application Recommended setting = 0 or 1.

02.11	Acceleration Rate
Coding	RW, Uni
Range:	0.0 - 3200.0
Units:	s/100Hz
Default settings:	5.0

This sets the Acceleration rate for Post ramp reference to ramp up to Pre ramp reference. when Post ramp reference is less than Pre-ramp reference.

02.20	Deceleration Selector
Coding	RW, Uni
Range:	0 – 9
Default settings:	0

This parameter is used to select Deceleration ramp rates as follows:

0   Ramp rate selection by terminal input

1   Ramp rate 1 selected

2   Ramp rate 2 selected

3   Ramp rate 3 selected

4   Ramp rate 4 selected

5   Ramp rate 5 selected

6   Ramp rate 6 selected

7   Ramp rate 7 selected

10   Ramp rate 8 selected

11   Ramp rate selection by preset reference selection

Application Recommended setting = 0 or 1.

02.21	Deceleration Rate	
Coding	RW, Uni	
Range:	Open loop	0.0 - 3200.0
Units:	Open loop	s/100Hz
Default settings:	5.0	

This sets the Deceleration rate for Post ramp reference to ramp down to Pre ramp reference when Post ramp reference is greater than Pre-ramp reference.

7.1.5   Menu 4

04.01	Motor current magnitude
Coding	RO, Uni, P
Range:	0 to maximum drive current
Units:	Amps

This parameter is the rms current from each output phase of the drive.

04.07	Symmetrical Current Limit
Coding	RW, Uni
Range:	0 to 400%
Units:	% of rated active current
Default settings:	150

This sets the symmetrical current as a percentage of Motor rated current.

7.1.6 Menu 5

05.01	Motor Frequency
Coding	RO, Bi, P
Range:	0 - 1000.0
Units:	Hz

This is the indication of Motor frequency. The range of this parameter is the maximum magnitude of Pr 01.06 and 01.07 plus whatever is added or subtracted for the slip compensation.

05.02	Motor Voltage
Coding	RO, Bi, P
Range:	0 – 528
Units:	Volts

This Indicates the Motor terminal voltage.

05.03	Motor Power
Coding	RO, Bi, P
Range:	+/- Max Drive power
Units:	kW

This Indicates the Motor Power.

05.04	Motor Speed
Coding	RO, Bi, P
Range:	+/- 60,000
Units:	rpm

The motor rpm is calculated from the post ramp reference.

05.05	DC Bus Voltage
Coding	RO, Uni, P
Range:	0 - 830
Units:	Volts

Voltage across the internal d.c. link of the drive.

05.06	Motor rated Frequency
Coding	RW, Uni
Range:	0 to 1000
Units:	Hz
Default settings:	Eur = 50.0 : USA = 60.0

The motor nameplate rated frequency.

05.07	Motor rated Current
Coding	RW, Uni
Range:	0 to Drive Rating
Units:	Amps
Default settings:	Drive Rating

The motor nameplate rated Current.

05.08	Motor rated Full load rpm
Coding	RW, Uni
Range:	0 to 60,000
Units:	rpm
Default settings:	0

The motor nameplate rated speed. If set greater than 0 in open loop this will enable slip compensation.

Application Recommended setting = 0.

05.09	Motor rated Voltage
Coding	RW, Uni
Range:	0 to 480
Units:	Volts
Default settings:	Eur = 400 : USA = 460

The motor nameplate rated Voltage.

05.10	Motor rated Power Factor
Coding	RW, Uni, S, P
Range:	0 to 1.000
Default settings:	0.920

The motor nameplate rated Power factor. This automatically set when an auto-tune is performed.

05.11	Motor Number of Poles
Coding	RW, Txt, P
Range:	2 –32
Units:	poles
Default settings:	4

Set to the no. of poles for the motor being used.

05.12	Magnetising Current test Enable
Coding	RW, Bit, P
Default settings:	0

In Open loop mode only the magnetising current test is performed. Once the test is complete Pr 05.12 is reset. If the power factor value set up as a result of this test is not accurate (i.e. because the motor is loaded), the voltage setting and hence the flux level at low frequencies will be incorrect.

05.13	Dynamic V/F select
Coding	RW, Bit
Default settings:	0

Setting this bit enables dynamic V / F mode which is intended for applications where power loss should be kept to a minimum under low load conditions. The rated frequency used to derive the Voltage / Frequency characteristic of the drive is varied with load:

Application Recommended setting = 1.

05.14	Voltage Mode select
Coding	RW, Txt, P
Range:	0 - 3
Default settings:	1

This parameter selects the voltage control mode used by the open loop drive. This falls into two categories: vector mode and fixed boost.

0 = Ur_S

1 = Ur_I

2 = Ur

3 = Fd

Application Recommended setting = 1 or 3.

05.15	Voltage Boost
Coding	RW, Uni
Range:	0 to 25.0
Units:	% of motor Volts
Default settings:	3.0

The boost level for the fixed boost characteristic is defined by this parameter, when parameter 05.14 = 3.

05.18	Switching Frequency
Coding	RW, Txt
Range:	3- 12
Units:	kHz
Default settings:	3

This define s the PWM switching frequency, selection range: - 3kHz, 4.5kHz, 6kHz, 9kHz & 12kHz.

7.1.7 Menu 6

06.01	Stop mode selector
Coding	RW, Txt
Range:	0 - 4
Default settings:	1

Defines the type of stopping mode when the run signal is removed.

0   COASt   Coast stop

1   rP   Ramp stop

2   rP.dcl   Ramp stop + 1 second dc injection

3   dcl   Injection braking stop with detection of zero speed

4   td.dcl   Timed injection braking stop

Application Recommended setting = 1

06.04	Sequencing Mode
Coding	RW, Uni, P
Range:	0 - 4
Default settings:	4

There are four sequencing modes available as shown below. Any terminal can be used for any of the functions provided in each mode (see sequencing bits below).

If any other sequencing mode is enabled the corresponding sequencing bits (Pr 06.30 to 06.34) must be also be programmed for particular use .

0   -   CD type interface

1   -   Mentor II type interface

2   -   Wire proof mode

3   -   PLC mode

4 - Wire proof PLC mode (default)

Application Recommended setting = 3 or 4.

06.09	Synchronize to a spinning motor
Coding	RW, Bit
Default settings:	0

When set will enable the drive to synchronise to a free spinning motor.

06.10	Spinning motor ramp rate
Coding	RW, Uni
Range:	0 - 25.0
Units:	S/100Hz
Default settings:	5.0

This parameter defines the rate at which the frequency is changed when trying to synchronize the motor speed.

06.37	Spinning motor start voltage
Coding	RW, Uni
Range:	0 - 100.0
Units:	% of normal operating voltage
Default settings:	25.0

Defines the voltage applied during a spin start as the % of voltage that would be applied in normal operation.

06.38	Spinning motor voltage ramp
Coding	RW, Uni
Range:	0 – 2.5
Units:	s
Default settings:	0.25

When the software has detected the motor speed it ramps the drives output voltage from the level programmed in Pr 06.37 to its normal operating voltage. This parameter determines the time interval for this change in voltage.

7.1.8 Menus 7 & 8

Refer to Unidrive Advance User manual for information on Digital & Analogue inputs and outputs.

7.1.9 Menu 10

10.34	No. of auto reset attempts
Coding	RW, Uni
Range:	0 - 5
Default settings:	0

If this parameter is set to zero then no auto reset attempts are made. Any other value will cause the drive to automatically reset following a trip for the number of times programmed. Pr 10.35 defines the time between the trip and the auto reset. The reset count is only incremented when the trip is the same as the previous trip, otherwise it is reset to 0. When the reset count reaches the programmed value, any further trip of the same type will not incur an auto-reset.

If there has been no trip for 5 minutes then the reset count is cleared.

10.35	**Auto reset delay**
Coding	RW, Uni
Range:	0.0 - 25.0
Units:	s
Default settings:	1.0

This parameter defines the time between a trip and an auto reset subject to the minimum trip time for IGBT over-current trips.

7.1.10 Menu 11

11.23	**Serial comms. address**
Coding	RW, Uni, P
Range:	0.0 - 9.9
Units:	Group.Unit
Default settings:	1.1

Used in ANSI comms to define the unique address for the drive. Any number in the permitted range 0.0 to 9.9 which has a zero in it should not be used as these are used in addressing groups of drives.

This parameter and all other serial interface parameters that follow (Pr 11.24 to 11.28) are only effective when the 'Serial Communications' Large option module is fitted.

11.24	**Serial comms. mode selector**
Coding	RW, Txt, R, P
Range:	0 - 3
Default settings:	1

This is the mode of operation of the serial port.

0   ANSI 2   ANSI protocol, two wire, half duplex serial comms.

1   ANSI 4   ANSI protocol, four wire, half duplex serial comms.

2   OUtPUt   Output variable defined by Pr 11.27(CT protocol)

3   INPUt   Input variable to parameter defined by 11.27(CT protocol)

Application Recommended setting = 0 or 3

11.25	**Serial comms. baud rate selector**
Coding	RW, Txt, P
Range:	0 - 2
Default settings:	0

Used in ANSI comms mode (2 or 4 wire) to select the comms port baud rate. Three available options are:

0   4,800 baud

1   9600 baud

2   19200 baud

11.26	**Serial comms. two wire mode delay selector**
Coding	RW, Uni
Range:	0 to 255

Units:	ms
Default settings:	0

The ANSI protocol is half duplex, and so it is possible to connect the RX and TX together and the / RX and / TX together and operate the comms with only 2 data connections. If Pr 11.24 is set to ANSI 2 two wire standard comms is active. Problems can occur with 2 wire mode comms if the drive replies to a request before the device that sent the request has been able to change its buffers from transmit to receive. To avoid this problem a delay, defined by Pr 11.26, can be introduced between the drive receiving data and then responding. The delay is always at least as long as the value programmed in Pr 11.26, but may be longer. Although the parameter resolution is 1ms, the actual timing resolution is 5ms: 1ms in the parameter will give a delay of at least 5ms, 4ms gives at least 5ms, 5ms gives at least 5ms, 6ms gives at least 10ms, etc.

7.1.11 Menu 16

Please refer to the additional I/O small option user manual for information on Digital & Analogue inputs and outputs.

Manual Description	CT Part Number
Additional I/O Small Option Module for Unidrive	0447-0046

7.1.12 Menu 17

17.13 Auto-run	
Coding	RW, Bit
Default settings:	1

Setting this parameter to 1 will cause the program in the UD70 to automatically execute whenever the drive is powered up. If this parameter is set to a zero, a run command is required via Sypt for the program to run.

NOTE

The following parameters are set by the Duty Assist application software and should not be changed by the user.

17.11 – Clock Task tick time.

17.14 – Global runtime trip enable

17.20 – Save NV data power down save

Changing these parameters will effect the overall operation of this software.

7.2 Application Parameters

7.2.1 Saving parameters

To save Menu 18 & 19 parameters to Non-volatile memory enter 1000 to any of the XX.00 parameters and press the reset button.

For Menu 20, set parameter 17.19 =1. This will automatically reset to 0 when the save has completed.

Menu 20 parameters will also be automatically saved to non-volatile memory on a power down.

7.2.2 Menu 18

18.01	Process Feedback
Coding	RO, U
Range:	0 - 32000
Units:	TIU

This indicates the Feedback signal in terminal interface units. E.g. the feedback signal value from the A to D converter. This parameter can be written to via serial communication when feedback is source remotely.

18.02	Process Feedback Selected
Coding	RO, U
Range:	18.14 to 18.12
Units:	EGU

Indication of the selected feedback used by the PID. This is scaled in Engineering units, which is determined by the scaling parameters 18.12 to 18.15. The selected feedback can be derived from Analogue 1 (default, or from parameter 18.01. Refer to Analogue feedback Enable parameter 18.38.

18.03	Process Set-point Selected
Coding	RO, U
Range:	18.14 to 18.12
Units:	EGU

Indication of the selected process set-point used by the PID. The selected feedback can be derived from Analogue 1 (default), scaled in Engineering units, (determined by the scaling parameters 18.12 to 18.15) or from parameter 18.01. Refer to the Analogue set point Enable parameter 18.37.

18.04	Manual Speed Set-point Selected
Coding	RO, U
Range:	0 – 01.06
Units:	0.1Hz

Indication of the selected speed reference used by the Unidrive when manual mode (Auto Select parameter 18.41=0). The selected set-point can be derived from Analogue 2 (default) or from parameter 20.21. Refer the Analogue Speed set-point Enable parameter 18.39.

18.05	Process PID Error
Coding	RO, U
Range:	18.14 to 18.12
Units:	EGU

Indication of the process error used by the PID and is the resultant of the process selected set-point & feedback, and Inverse Speed Profile Enable Parameter (18.31).

18.31 = 0

Error = Set-point (18.03) - Feedback (18.02)

18.31 = 1

Error = Feedback (18.02) – Set-point (18.03)

This error indication is dependant on the setting of the PID Always enabled parameter (18.44): -

18.44 = 0

The error value is only visible when the system is in Auto and running.

18.44 = 1

The error value is visible always.

18.06	Start Assist Request
Coding	RO, Bit

This indicates an assist starter is requested to start.

18.07	Stop Assist Request
Coding	RO, Bit
Range:	0 – 32000

This indicates an assist starter is requested to stop.

18.08	Duty Only Running
Coding	RO, Bit

This indicates only the duty drive is currently running with no assist starters.

18.09	Sleep Initiated
Coding	RO, Bit

This indicates the Sleep threshold (18.25) has been exceeded and a sleep-to-stop the drive has been initiated. The drive will stop when the Sleep delay (18.26) has been exceeded.

18.10	Wake Initiated
Coding	RO, Bit

This indicates the Wake threshold (18.27) has been exceeded and a wake-to-start the drive has been initiated. The drive will start when the Wake delay (18.28) has been exceeded.

18.11	Process Preset Set-point 1
Coding	RW, U
Range:	18.14 to 18.12
Units:	EGU
Default settings:	500

This is the parameter for the process set-point and it is enable by selecting analogue set-point enable parameter 18.37 = 0. This parameter can be set locally from the Unidrive keypad or written to remotely via serial communication.

18.12	Feedback Scaling EGU High Value
Coding	RW, B
Range:	-32000 - + 32000
Units:	EGU
Default settings:	1000

This scales the required EnGineering Units high value to the corresponding Terminal Interface Unit high value. The value is to be set as an integer, therefore to maintain resolution of controllable engineering range, the value can be set as a fixed point integer as shown below.

e.g. A linear feedback source is connected to analogue input 1, where the input resolution is 0 – 4000 then,

TIU low (18.15) = 0 & TIU High (18.13) = 4000.

The required equivalent real Engineering Unit range is 4.00 to 10.00bar therefore,

EGU Low (18.14) = 400 & EGU High (18.12) = 1000

18.13	Feedback Scaling TIU High Value
Coding	RW, B
Range:	-32000 - + 32000
Units:	TIU
Default settings:	4000

This defines the terminal interface unit's High value and it corresponds to the max range of the analogue A-D range.

Refer to parameter 18.12 example.

18.14	Feedback Scaling EGU Low Value
Coding	RW, B
Range:	-32000 - + 32000
Units:	EGU
Default settings:	0

This scales the required Engineering Units Low value to the corresponding Terminal interface Unit Low value (18.15). The value is to be set as an integer, therefore to maintain resolution of controllable engineering range the value can be set as a fixed point integer as shown below.

Refer to parameter 18.12 example.

18.15	Feedback Scaling TIU Low Value
Coding	RW, U
Range:	-32000 - + 32000
Units:	TIU
Default settings:	0

This defines the terminal interface unit's High value and it corresponds to the max range of the analogue A-D range.

Refer to parameter 18.12 example.

18.16	Process Set-point Slew Rate
Coding	RW, U
Range:	0 – 32000
Units:	EGU's / second
Default settings:	0

This sets the process set-point slew rate and limits the rate of change of the applied set-point value to the PID. This parameter is useful in reducing system oscillations with large changes with the set-point, typical application pressure control with high lift pumps, e.g. borehole pumps.

18.17	PID Proportional Gain
Coding	RW, U
Range:	0 – 32000
Units:	0.01Kp
Default settings:	100

This sets the proportion gain applied to the PID error.

For a process error of 1, and a Proportional gain of 100, the output of the P term will be 1, which is equivalent to 0.1Hz.

Refer to parameter PID output scalar, (20.20) for changes with gain range/scaling.

18.18	PID Integral Gain
Coding	RW, U
Range:	0 – 32000
Units:	0.1Ki.sec
Default settings:	50

This sets the Integral gain applied to the PID error.

For a constant error of 1, and an Integral gain of 10, the output of the Iterm will reach 1 after 1 second, which is equivalent to 0.1Hz.

Refer to parameter PID output scalar, (20.20) for changes with gain range/scaling.

18.19	PID Differential Gain
Coding	RW, U
Range:	0 – 32000
Units:	0.1Kd /sec
Default settings:	0

This sets the Differential gain applied to the PID error.

For a constant rate of change of error of 1 count per second and a differential gain of 10, the output of the D term will be 1, which is equivalent to 0.1Hz.

Refer to parameter PID output scalar, (20.20) for changes with gain range/scaling.

18.20	Start Assist Threshold
Coding	RW, U
Range:	01.07 − #01.06
Units:	0.1 Hz
Default settings:	450

This sets the motor frequency threshold level to request an assistance of an additional starter. This should be set higher than stop assist threshold (18.22).

18.21	Start Assist Delay
Coding	RW, U
Range:	0 − 32000
Units:	0.1 Seconds
Default settings:	100

This defines the delay for the assist starter to start when the start threshold (18.20) has been exceeded.

18.22	Stop Assist Threshold
Coding	RW, U
Range:	01.07 − #01.06
Units:	0.1 Hz
Default settings:	100

This sets the motor frequency threshold level to request the stopping of an assist starter. This should be set lower than start assist threshold (18.20).

18.23	Stop Assist Delay
Coding	RW, U
Range:	0 − 32000
Units:	0.1 Seconds
Default settings:	100

This defines the delay for the assist starter to stop when the stop threshold (18.22) has been exceeded.

18.24	Override Delay
Coding	RW, U
Range:	0 − 32000
Units:	0.1 Seconds
Default settings:	20

This will override the start and stop assist delay (18.21 & 18.23) when the Override enable parameter (18.32) is set and the process error exceeds the override symmetrical threshold (20.40).

18.25	Sleep Threshold
Coding	RW, U
Range:	01.07 − 01.06
Units:	0.1 Hz
Default settings:	200

This defines the speed threshold level to initiate the drive to sleep. This is active when the Sleep/Wake Enable parameter (18.33) is set and the

Duty drive is running only (18.08 =1). This should be set lower than the start assist threshold parameter (18.20).

18.26	Sleep Delay
Coding	RW, U
Range:	0 – 32000
Units:	0.1 Seconds
Default settings:	100

This defines the delay for the Duty drive to stop & sleep, when the sleep threshold (18.25) has been exceeded.

18.27	Wake Threshold
Coding	RW, U
Range:	18.14 – 18.12
Units:	EGU
Default settings:	210

This defines the process feedback threshold level to initiate the drive to wake. This is active when the Sleep/Wake Enable parameter (18.33) is set. The wake threshold can be configured to wake above or below this threshold by wake below parameter (18.34).

18.28	Wake Delay
Coding	RW, U
Range:	0 – 32000
Units:	0.1 Seconds
Default settings:	100

This defines the delay for the Duty drive to start & wake when the wake threshold (18.27) has been exceeded.

18.29	Mode Select
Coding	RW, U
Range:	1 – 4
Units:	N/A
Default settings:	1

This selects the required control Mode configuration:

1 – Fixed Duty, with 4 assist starter enabled by order of Sequence.

2 – Duty rotated, with 3 assist starter enabled by order of Sequence.

3 – Fixed Duty, with 4 assist starter enabled by order of Runtime.

4 – Duty rotated, with 3 assist starter enabled by order of Runtime.

This parameter can only be changed when the system is stopped. (E.g. Duty drive not running and assist starter are not running in auto).

Sequence mode:

Each starter is selected/deselected by a predefined, fixed sequence defined by Sequence parameter (19.19).

Runtime:

Each starter is selected/deselected by its runtime.

Fixed Duty:

The Duty drive is allocated to one motor only.

Duty Rotated:

The Duty drive can be selected to any motor on the system by switching external contactors.

18.30	Number of Starters
Coding	RW, U
Range:	1 – 4
Units:	N/A
Default settings:	4

This defines the number of Starter on the system, excluding the duty drive.

In sequence modes, (18.29 = 1 or 3) this will limit the number of starters to be sequentially started and stopped. Refer to the sequence parameter (19.19), for more details on the set up of the order with respect to number of starters.

In runtime mode this will also limit the number starters to started and stopped, b ut it is important for to ensure the available status on the starters not in used is set to 0, therefore they will be ignored during Runtime selection. Refer to available parameters 19.43, 19.45, 19.47 & 19.49.

This parameter can only be changed when the system is stopped. (E.g. Duty drive not running and assist starter are not running in auto).

18.31	Inverse Speed Profile Enable
Coding	RW, B
Default settings:	0

When set will invert the process set-point and feedback values to give an inverted speed characteristic on the output of the PID. This is applicable to processes where the speed is required to reduce with a positive increase in PID error. E.g. Temperature control by Fan cooling.

18.32	Process Preset Set point 2 Select
Coding	RW, B
Default settings:	0

This parameter selects the source of the set point parameter reference, when in parameter mode (18.37=0).

0 = Preset Set point 1 (18.11)

1 = Preset Set point 2 (20.40)

18.33	Sleep/Wake Enable
Coding	RW, B
Default settings:	0

This will set the Sleep/Wake feature.

Corresponding parameters (18.25 to18.28 & 18.34)

Warning Drive could Start and Stop un- expectantly when this feature is enabled as it is automatically under control of the feedback signal and drive frequency.

18.34	Wake Below Enable
Coding	RW, B
Default settings:	0

When set this will Wake/start the drive when the process feedback signal falls below the Wake threshold (18.27) and the wake delay has elapsed (18.28).

When set to zero this will Wake/start the drive when the process feedback signal goes above the Wake threshold (18.27) and the wake delay has elapsed (18.28).

18.35	Process Feedback Alarms Enable
Coding	RW, B
Default settings:	0

When set will enable the process feedback alarm thresholds to be active.

18.36	No Flow Protection Enable
Coding	RW, B
Default settings:	0

When set will enable the No flow protection on each starter. When Fix Duty mode is selected (18.29 = 1 or 3), the duty no flow will trip the Unidrive, 'TR82' when detected.

18.37	Analogue Process Set-point Enable
Coding	RW, B
Default settings:	1

This will select the source of the process set-point.

0 – Preset set-point from parameter 18.11

1 – Analogue reference from AN2 input terminal 7.

18.38	Analogue Process Feedback Enable
Coding	RW, B
Default settings:	1

This will select the source of the process feedback.

0 – Feedback is written directly to parameter 18.01. This is only achievable via serial communications.

1 – Analogue reference from AN1 input terminal 5 & 6.

18.39	Analogue Speed Set-point Enable
Coding	RW, B
Default settings:	1

This will select the source of the Manual Speed reference.

0 – Speed set-point from parameter 20.21.

1 – Analogue reference from AN2 input terminal 7.

Note this has the same analogue input as the process analogue set-point, but its function is determine by the Auto/man mode selected (18.41)

18.40	System Run
Coding	RW, B
Default settings:	0

Set to 1 will run the system.

Set to 0 will stop the system.

Terminal default setting: Digital input F6 Terminal 29.

Note: This bit parameter does not indicate the status when the corresponding run bit is used with the remote control word (73.70 bit 1).

18.41	System Auto Select
Coding	RW, B
Default settings:	1

Set to 1 the system will be in automatic mode and the Duty drive speed will be controlled from the process PID.

Set to 0 the system will be in manual mode and the Duty drive speed will be derived from the manual speed set-point.

Terminal default setting mode 2 (19.25): Digital input F5 Terminal 28.

This bit parameter can be set remotely by using the Auto bit 5 of the Remote control word parameter (73.70), when remote select parameter (18.42) is set. Sourcing from the Unidrive digital inputs will have priority over the control word auto bit.

18.42	Remote Select
Coding	RW, B
Default settings:	0

This determines the source of the I/O control.

Set to 0, the System Run and Auto select is provided locally by parameters 18.40 & 18.41 respectively.

Set to 1, System Run and Auto select is provided remotely by the control word parameter 73.70).

This parameter can be set by sourcing a local digital input or by the control word parameter (73.70 bit 4).

Sourcing from the Unidrive digital inputs will have priority over the control word auto bit.

18.43	Cascade Stop Enable
Coding	RW, B
Default settings:	1

Set to 1, will cascade stop each starter running in a controlled manner. This will minimise any hydraulic or pressure shocks during stopping of the process. The cascade delay between each starter is set by parameter 20.22.

Set to 0, the system starters are all stopped instantaneously after the duty has ramped to stop.

18.44	PID Always Enable
Coding	RW, B
Default settings:	0

This will enable the PID to be active when the duty drive is stopped or running. When set to 0 the PID is only active the Duty drive is running in Auto mode.

CAUTION

In some applications it is advisable that the drive ramps are set when using this feature. This will ensure when the drive is enabled, with a large process error present, the drive will ramp up to speed in a controlled manner within the system limits.

18.45	Starter 1 Enable
Coding	RO, B

This indicates the enable for starter 1.

Terminal default settings (19.25):

Mode 1 - Digital Output F3 Terminal 26

Mode 2 - Digital Output F3 Terminal 26

18.46	Starter 2 Enable
Coding	RO, B

This indicates the enable for starter 2.

Terminal default settings (19.25):

Mode 1 - Relay Output Terminals 1 & 2

Mode 2 - Relay Output Terminals 1 & 2

18.47	Starter 3 Enable
Coding	RO, B

This indicates the enable for starter 3.

Terminal default settings (19.25):

Mode 2 - Relay Output Terminals 40 & 42 (Option Module)

18.48	Starter 4 Enable
Coding	RO, B

This indicates the enable for starter 4.

Terminal default settings (19.25):

Mode 2 - Relay Output Terminals 41 & 42 (Option Module)

18.49	Cycle Enable
Coding	RW, B
Default settings:	0

This feature is only applicable in runtime Modes (18.29 = 3 or 4)

When set this will ensure the system starters are rotated during lengthy operation times. On occasions not all the starters are required to run to meet required demand range, therefore the same starters may be running for long durations. Setting the Cycle Enable will stop the starters after a Cycle delay time has elapsed (20.23). The system will be automatically restarted again allowing the lowest starter to be selected.

18.50	System Reset	
Coding	RW, B	
Default settings:	0	

When set will reset the system and Drive.

Terminal default setting mode 2 (19.25): Digital input F4 Terminal 27.

This parameter can be set by sourcing a local digital input or by the control word (73.70 bit 6). If source directly to a local I/O this would have priority over the control word bit.

7.2.3 Menu 19

19.01	Duty Runtime Hours & Minutes
Coding	RO, U
Range:	0 - 2359
Units:	HHMM

Together with the parameter #19.02 the application software records the amount of time the Duty drive has been running in Hours and minutes. This parameter is non-volatile therefore the value is retained during a power down. Setting the Run time reset parameter 19.26 = 1 will reset the current runtime value.

Note: The Duty Runtime parameter is enabled only in Fixed Duty Mode (18.29 = 1 or 3).

19.02	Duty Runtime Days
Coding	RO, U
Range:	0 – 32000
Units:	Days

Together with the parameter #19.01 the application records the amount of time the Duty drive has been running in Days. This parameter is non-volatile therefore the value is retained during a power down. Setting the Run time reset parameter 19.26 = 1 will reset the current runtime value.

Note: The Duty Runtime parameter is enabled only in Fixed Duty Mode (18.29 = 1 or 3).

19.03	Starter 1 Runtime Hours & Minutes
Coding	RO, U
Range:	0 – 2359
Units:	HHMM

Together with the parameter #19.04 the application software records the amount of time Starter 1 has been running in Hours and minutes. This parameter is non-volatile therefore the value is retained during a power down. Setting the Run time reset parameter 19.27 = 1 will reset the current runtime value.

19.04	Starter 1 Runtime Days
Coding	RO, U
Range:	0 – 32000
Units:	Days

Together with the parameter #19.03 the application software records the amount of time Starter 1 has been running in Days. This parameter is non-volatile therefore the value is retained during a power down. Setting the Run time reset parameter 19.27 = 1 will reset the current runtime value.

19.05	Starter 2 Runtime Hours & Minutes
Coding	RO, U
Range:	0 -2359
Units:	HHMM

Together with the parameter #19.06 the application software records the amount of time Starter 2 has been running in Hours and minutes.

This parameter is non-volatile therefore the value is retained during a power down. Setting the Run time reset parameter 19.28 = 1 will reset the current runtime value.

19.06	Starter 2 Runtime Days
Coding	RO, U
Range:	0 - 32000
Units:	Days

Together with the parameter #19.05 the application software records the amount of time Starter 2 has been running in Days. This parameter is non-volatile therefore the value is retained during a power down. Setting the Run time reset parameter 19.28 = 1 will reset the current runtime value.

19.07	Starter 3 Runtime Hours & Minutes
Coding	RO, U
Range:	2359
Units:	HHMM

Together with the parameter #19.08 the application software records the amount of time Starter 3 has been running in Hours and minutes. This parameter is non-volatile therefore the value is retained during a power down. Setting the Run time reset parameter 19.29 = 1 will reset the current runtime value.

19.08	Starter 3 Runtime Days
Coding	RO, U
Range:	0 - 32000
Units:	Days

Together with the parameter #19.07 the application software records the amount of time Starter 3 has been running in Days. This parameter is non-volatile therefore the value is retained during a power down. Setting the Run time reset parameter 19.29 = 1 will reset the current runtime value.

19.09	Starter 4 Runtime Hours & Minutes
Coding	RO, U
Range:	0 - 2359
Units:	HHMM

Together with the parameter #19.10 the application software records the amount of time Starter 4 has been running in Hours and minutes. This parameter is non-volatile therefore the value is retained during a power down. Setting the Run time reset parameter 19.30 = 1 will reset the current runtime value.

19.10	Starter 4 Runtime Days
Coding	RO, U
Range:	0 - 32000
Units:	Days

Together with the parameter #19.09 the application software records the amount of time Starter 4 has been running in Days. This parameter is non-volatile therefore the value is retained during a power down.

Setting the Run time reset parameter 19.30 = 1 will reset the current runtime value.

19.11	Low Alarm Threshold
Coding	RW, U
Range:	18.14 to 18.12
Units:	EGU
Default settings:	100

This defines the Low Alarm Threshold of the process feedback signal.

This is only monitored when the Process Feedback Alarms are enabled (18.35) and the Duty Drive is running (10.02).

This threshold can be used as a pre-alarm for the Low-Low threshold parameter (19.12)

19.12	Low-Low Alarm Threshold
Coding	RW, U
Range:	18.14 to 18.12
Units:	EGU
Default settings:	50

This defines the Low-Low Alarm Threshold of the process feedback signal.

This is only monitored when the Process Feedback Alarms are enabled (18.35) and the Duty Drive is running (10.02).

If the Low trip enable parameter (19.21) is set, this threshold will be configured as the ultimate Low trip level, which will trip the Unidrive on 'TR80'.

The Low Alarm threshold (19.11) will be ignored this threshold is set higher.

19.13	Low Alarm Delay
Coding	RW, U
Range:	0 – 32000
Units:	0.1 Seconds
Default settings:	100

To reduce spurious indication, this provides a time delay for the acknowledgment of any of the Low Alarms.

19.14	High Alarm Threshold
Coding	RW, U
Range:	18.14 to 18.12
Units:	EGU
Default settings:	900

This defines the High Alarm Threshold of the process feedback signal.

This is only monitored when the Process Feedback Alarms are enabled (18.35) and the Duty Drive is running (10.02).

This threshold can be used as a pre-alarm for the High-High threshold parameter (19.15)

19.15	High-High Alarm Threshold
Coding	RW, U
Range:	18.14 to 18.12
Units:	EGU
Default settings:	1000

This defines the High-High Alarm Threshold of the process feedback signal.

This is only monitored when the Process Feedback Alarms are enabled (18.35) and the Duty Drive is running (10.02).

If the Low trip enable parameter (19.20) is set, this threshold will be configured as the ultimate Low trip level, which will trip the Unidrive on 'TR81'.

The High Alarm threshold (19.14) will be ignored if this threshold is set higher.

19.16	High Alarm Delay
Coding	RW, U
Range:	0 – 32000
Units:	0.1 Seconds
Default settings:	100

To reduce spurious indication, this provides a time delay for the acknowledgment of any of the High Alarms.

19.17	No Flow Delay
Coding	RW, U
Range:	0 – 32000
Units:	0.1 Seconds
Default settings:	100

This defines the overall time delay for acknowledgment of a No Flow alarms. The delay should be set to a value that ensures enough time for the slowest starter* to get up to a speed and establish adequate flow for the flow switch to activate.

- - Defines the starter with the slowest acceleration time. This is usually the Duty Unidrive as the ramps are user definable.

19.18	Transition Delay
Coding	RW, U
Range:	0 – 32000
Units:	0.1 Seconds
Default settings:	100

This delay time is used in two control functions: -

1. Defines the time to start another starter if the Request to Start (18.06) remains high due to: -

        i.   The previous Assist had failed to start.

        ii. The demand was not fulfilled with the previous starter.

2. Defines the time to stop another starter if the Request to Stop (18.07) remains high due to:-

        i.   The demand was not fulfilled with the previous starter.

19.19	Starter Sequence
Coding	RW, U
Range:	1234 – 4321
Units:	N/A
Default settings:	1234

This defines the start/stop order of the starters when operating in one of the fixed sequence modes, (18.29 = 1 or 2).

e.g. With the sequence set to 1234, the starting order when requested to start will be starter 1, 2, 3, & 4. The stopping order when requested to stop will be vice versa, starter 4, 3, 2 & 1.

No starter number can be repeated more than once. The order always starts from the most significant digit and is applicable to any number of starters used (18.30). E.g. with 3 starters it is the responsibility of the user to ensure the first 3 digits values correspond to the starters used.

19.20	Process Feedback High Trip Enable
Coding	RW, B
Default settings:	0

When set this enable the drive to trip (Tr81) when the High-High Threshold (19.15) has been exceeded for the high threshold duration (19.16)

19.21	Process Feedback Low Trip Enable
Coding	RW, B
Default settings:	0

When set this enable the drive to trip (Tr80) when the Low-Low Threshold (19.12) has been exceeded for the Low threshold duration (19.13)

19.22	Assist Fail to Start Trip Indication
Coding	RO, Uni

When an assist has failed to start this indicates each starter number that has failed and the order each were detected.

e.g. if the system has 3 starters that has fail to start and they were detected in the following order: -

Starter 2 failed first

Starter 4 failed second

Starter 3 failed third

Then this parameter would display '342', where the least significant number was the first starter to fail.

This parameter will be set to zero when a system reset has been performed.

19.23	Starter No Flow Trip Indication
Coding	RO, Uni

When a starter No Flow has been detected this indicates each starter number that has failed and the order each were detected.

e.g. if the system has 3 starters that has fail to start and they were detected in the following order: -

Starter 2 failed first

Starter 4 failed second

Starter 3 failed third

Then this parameter would display '342', where the least significant number was the first starter to fail.

19.24	Parameter Defaults Enable
Coding	RW, B
Default settings:	0

This will set Duty-Assist application parameters to default values. It will also configure the following Unidrive parameters, as these are essential settings for this application to run successfully.

01.10 Bipolar Reference Enable = 0

01.14 Reference Selector   = 3

01.15 Preset Speed Selector   = 1

06.01 Stopping Mode   = 1

06.04 Sequencing Logic Mode= 4

This parameter can only be changed when the system is stopped. (E.g. Duty drive not running and assist starter are not running in auto).

Set to 1 the software will default parameters and when successfully completed will reset this parameter back to 0.

19.25	Terminal I/O Select
Coding	RW, Uni
Range	0 – 2
Default settings:	0

This selects the terminal default mappings for the application. There a re two selections available: -

0 = No selection, user fully configurable.

1 = Unidrive I/O only, to control up to 2 starters only.

2 = Unidrive I/O & I/O SOM (UD50), to control up to 4 starters.

If terminal mode 2 is selected without the I/O module being fitted the system will trip 'Tr85'.

This parameter can only be changed when the system is stopped. (E.g. Duty drive not running and assist starter are not running in auto).

19.26	Duty Runtime Reset
Coding	RW, B
Default settings:	0

When set will reset the Duty runtime counter values (19.01 & 19.02).

19.27	Starter 1 Runtime Reset
Coding	RW, B
Default settings:	0

When set will reset Starter 1 runtime counter values (19.03 & 19.04).

19.28	Starter 2 Runtime Reset
Coding	RW, B
Default settings:	0

When set will reset Starter 2 runtime counter values (19.05 & 19.06).

19.29	Starter 3 Runtime Reset
Coding	RW, B
Default settings:	0

When set will reset Starter 3 runtime counter values (19.07 & 19.08).

19.30	Starter 4 Runtime Reset
Coding	RW, B
Default settings:	0

When set will reset Starter 4 runtime counter values (19.09 & 19.10).

19.31	Starts Per Hour Protection Enable
Coding	RW, B
Default settings:	0

This will enable the number of starts per hour protection for each starter. Refer to parameters 20.25 to 20.33 for set up and indication. When a starter reaches its limit of number of starts it will not be permitted to restart until the current active hour has elapsed.

19.32	Assist Fail to Start
Coding	RO, B
Default settings:	0

This indicates one or more Assist starters has failed to start. Refer to Assist Fail to Start Trip Indication parameter (19.22) to determine the starter that has failed. If all assist starters fail to start then the drive will trip (TR83).

19.33	Duty No Flow
Coding	RW, B
Default settings:	0

This parameter is indication of the status of the Duty flow switch and when required should be sourced from a local digital input, on the Unidrive or I/O SOM, or set remotely via serial communications.

0 = No Flow (Fail safe) and 1 = Flow.

If Fix Duty mode is selected (18.29 = 1 or 3), the duty no flow will trip the Unidrive when detected on (TR82)

19.34	Starter 1 No Flow
Coding	RW, B
Default settings:	0

This parameter is indication of the status of the Starter 1 flow switch and if required should be sourced from a local digital input on the Unidrive or I/O SOM, or set remotely via serial communications.

0 = No Flow (Fail safe) and 1 = Flow.

19.35	Starter 2 No Flow
Coding	RW, B
Default settings:	0

This parameter is indication of the status of the Starter 2 flow switch and if required should be sourced from a local digital input on the Unidrive or I/O SOM, or set remotely via serial communications.

0 = No Flow (Fail safe) and 1 = Flow.

19.36	Starter 3 Flow
Coding	RW, B
Default settings:	0

This parameter is indication of the status of the Starter 3 flow switch and if required should be sourced from a local digital input on the Unidrive or I/O SOM, or set remotely via serial communications.

0 = No Flow (Fail safe) and 1 = Flow.

19.37	Starter 4 No Flow
Coding	RW, B
Default settings:	0

This parameter is indication of the status of the Starter 4 flow switch and if required should be sourced from a local digital input on the Unidrive or I/O SOM, or set remotely via serial communications.

0 = No Flow (Fail safe) and 1 = Flow.

19.38	No Flow Flag
Coding	RO, B

This indicates No flow has been detected with one or more starters. Refer to Starter No Flow Trip Indication parameter (19.23) to determine the starter that has failed.

19.39	Low Alarm Flag
Coding	RO, B

This indicates the process feedback is equal or below the Low alarm threshold (19.11) for the duration that exceeds the Low alarm delay (19.13).

19.40	Low-Low Alarm Flag
Coding	RO, B

This indicates the process feedback is equal or below the Low-Low alarm threshold (19.12) for the duration that exceeds the Low alarm delay (19.13).

19.41	High Alarm Flag
Coding	RO, B

This indicates the process feedback is equal or above High alarm threshold (19.14) for the duration that exceeds the High alarm delay (19.16).

19.42	High-High Alarm Flag
Coding	RW, B

This indicates the process feedback is equal or above High-High alarm threshold (19.15) for the duration that exceeds the High alarm delay (19.16).

19.43	Starter 1 Available
Coding	RW, B
Default settings:	0

This indicates the availability status of Starter 1, e.g. Starter ready for selection - healthy and auto mode is selected locally on starter, (When Auto/Man control modes are adopted on starter panel). This can be sourced from a local digital input on the Unidrive or I/O SOM.

0 = Not Available and 1 = Available.

Terminal default settings (19.25):

Mode 1 – Digital Input F1 Terminal 24

Mode 2 - Digital Input F1 Terminal 24

19.44	Starter 1 Running
Coding	RW, B
Default settings:	0
Default settings:	0

This indicates the running status of Starter 1. This can be sourced from a local digital input on the Unidrive or I/O SOM.

0 = Stopped and 1 = Running.

Terminal default settings (19.25):

Mode 1 – Digital Input F2 Terminal 25

Mode 2 - Digital Input F2 Terminal 25

19.45	Starter 2 Available
Coding	RW, B
Default settings:	0

This indicates the availability status of Starter 2, e.g. Starter ready for selection - healthy and auto mode is selected locally on starter, (When Auto/Man control modes are adopted on starter panel). This can be sourced from a local digital input on the Unidrive or I/O SOM.

0 = Not Available and 1 = Available.

Terminal default settings (19.25):

Mode 1 - Digital Input F4 Terminal 27

Mode 2 - Digital Input F9 Terminal 48 (SOM)

19.46	Starter 2 Running
Coding	RW, B
Default settings:	0

This indicates the running status of Starter 2. This can be sourced from a local digital input on the Unidrive or I/O SOM.

0 = Stopped and 1 = Running.

Terminal default settings (19.25):

Mode 1 – Digital Input F5 Terminal 28

Mode 2 - Digital Input F10 Terminal 49 (SOM)

19.47	Starter 3 Available
Coding	RW, B
Default settings:	0

This indicates the availability status of Starter 3, e.g. Starter ready for selection - healthy and auto mode is selected locally on starter, (When Auto/Man control modes are adopted on starter panel). This can be sourced from a local digital input on the Unidrive or I/O SOM.

0 = Not Available and 1 = Available.

Terminal default settings (19.25):

Mode 1 – N/A

Mode 2 - Digital Input F11 Terminal 50 (SOM)

19.48	Starter 3 Running
Coding	RW, B
Default settings:	0

This indicates the running status of Starter 3. This can be sourced from a local digital input on the Unidrive or I/O SOM.

0 = Stopped and 1 = Running.

Terminal default settings (19.25):

Mode 1 – N/A

Mode 2 - Digital Input F12 Terminal 44 (SOM)

19.49	Starter 4 Available
Coding	RW, B
Default settings:	0

This indicates the availability status of Starter 3, e.g. Starter ready for selection - healthy and auto mode is selected locally on starter, (When Auto/Man control modes are adopted on starter panel). This can be sourced from a local digital input on the Unidrive or I/O SOM.

0 = Not Available and 1 = Available.

Terminal default settings (19.25):

Mode 1 – N/A

Mode 2 - Digital Input F13 Terminal 45 (SOM)

19.50	Starter 4 Running
Coding	RW, B
Default settings:	0

This indicates the running status of Starter 4. This can be sourced from a local digital input on the Unidrive or I/O SOM.

0 = Stopped and 1 = Running.

Terminal default settings (19.25):

Mode 1 – N/A
Mode 2 - Digital Input F14 Terminal 46 (SOM)

7.2.4   Menu 20

Parameters 20.01 to 20.19 are reserved for Fieldbus set up parameters. Please refer to the following list of manuals for the parameter allocations and set-up.

Manual Description	CT Part Number
Profibus-DP	0460-0075
Interbus	0460-0076
Modbus-Plus	0400-0035
CTNet	0460-0025
Devicenet	0460-0077
CAN	0460-0063
CANOpen	0460-0061
UD70 RS485 Port (CTANSI, Modbus_RTU, custom)	0447-0017

20.20	PID Output Scalar
Coding	RW, U
Range:	1 – 32000
Units:	%
Default:	1

This is a PID output scalar to increase the range of the PID output to enable longer integration times if required.

e.g. If the PID scalar is set to 1, the PID output range is 0 – (Max Speed *10), Therefore the Integral gain if set to 10 (gain of 1), and there is a steady state error of 1, the PID output will increase by 0.1Hz every second.

If the scalar was set to 10, with the same Integral gain and error above then the output will increase by 0.01Hz every second

20.21	Remote Speed Reference
Coding	RW, U
Range:	01.07 – 01.06
Units:	0.1Hz
Default:	0

This is the parameter speed set-point and it is enable by selecting analogue speed set-point enable parameter 18.39 = 0. This parameter can be used locally from the Unidrive keypad or written to remotely via serial communication.

20.22	Cascade Stop Delay
Coding	RW, U
Range:	0 – 32000
Units:	0.1 Seconds
Default:	20

This defines the interval time between each starter stop command when the Cascade stop is enabled (18.43) and the System stop is commanded (18.40).

20.23	Cycle Time
Coding	RO, U

Range:	1 – 32000
Units:	Hours
Default:	24

When the Cycle Enable parameter (18.49) is set, this time delay defines the period for the system to cycle the starters.

e.g. if the same starters have been running for same or longer than the cycle time, then the system will stop and restart with the selecting the starter with the lowest runtime.

This feature is only applicable in runtime Modes (18.29 = 3 or 4).

20.24	**PID Output Scaled**
Coding	RO, U
Range:	+/- 32000
Units:	Hz * (10 * 20.20)

This indicates the scaled PID output.

20.24 = (01.07 – 01.06) * 10 * 20.20

Note: this will saturate at +/-32000.

20.25	**Starter 1 Number of Starts Per Hour**
Coding	RW, U
Range:	1 – 32000
Default:	5

When the Start per hour protection is enabled (19.31), this defines the maximum permitted number of start per hour for Starter 1. This is dependant on the fixed starting method used. Please consult your motor manufacturer/manual for correct setting.

20.26	**Starter 2 Number of Starts Per Hour**
Coding	RW, U
Range:	1 – 32000
Default:	5

When the Start per hour protection is enabled (19.31), this defines the maximum permitted number of start per hour for Starter 2. This is dependant on the starting method used. Please consult your motor manufacturer/manual for correct setting.

20.27	**Starter 3 Number of Starts Per Hour**
Coding	RW, U
Range:	1 – 32000
Default:	5

When the Start per hour protection is enabled (19.31), this defines the maximum permitted number of start per hour for Starter 3. This is dependant on the starting method used. Please consult your motor manufacturer/manual for correct setting.

20.28	**Starter 4 Number of Starts Per Hour**
Coding	RW, U
Range:	1 – 32000
Default:	5

When the Start per hour protection is enabled (19.31), this defines the maximum permitted number of start per hour for Starter 4. This is dependant on the starting method used. Please consult your motor manufacturer/manual for correct setting.

20.29	Starter 1 Number of Starts Per Hour Counter
Coding	RO, U
Range:	1 to 20.25
Units:	No of Starts

This indicates Starter 1 number of starts counted for within the current Elapsed hour (20.33). This is reset when an hour has elapsed.

20.30	Starter 2 Number of Starts Per Hour Counter
Coding	RO, U
Range:	1 to 20.25
Units:	No of Starts

This indicates Starter 2 number of starts counted within the current Elapsed hour (20.34). This is reset when an hour has elapsed.

20.31	Starter 3 Number of Starts Per Hour Counter
Coding	RO, U
Range:	1 to 20.25
Units:	No of Starts

This indicates Starter 3 number of starts counted within the current Elapsed hour (20.35). This is reset when an hour has elapsed.

20.32	Starter 4 Number of Starts Per Hour Counter
Coding	RO, U
Range:	1 to 20.25
Units:	No of Starts

This indicates Starter 4 number of starts counted within the current elapsed hour (20.36). This is reset when an hour has elapsed.

20.33	Starter 1 Start per Hour Elapse Time
Coding	RO, U
Range:	0 − 59
Units:	Minutes

The hour timer is started when the starter is run with no current counts accumulated in the SPH Counter (18.29). This is reset to 0 when an hour has elapsed.

20.34	Starter 2 Start per Hour Elapse Time
Coding	RO, U
Range:	0 − 59
Units:	Minutes

The hour timer is started when the starter is run with no current counts accumulated in the SPH Counter (18.29). This is reset to 0 when an hour has elapsed.

20.35	Starter 3 Start per Hour Elapse Time
Coding	RO, U
Range:	0 - 60
Units:	Minutes

The hour timer is started when the starter is run with no current counts accumulated in the SPH Counter (18.29). This is reset to 0 when an hour has elapsed.

20.36	Starter 4 Start per Hour Elapse Time
Coding	RO, U
Range:	0 - 60
Units:	Minutes

The hour timer is started when the starter is run with no current counts accumulated in the SPH Counter (18.29). This is reset to 0 when an hour has elapsed.

20.37	Communications Watchdog Enable
Coding	RW, B
Default settings:	0

When set will enable the Communication watchdog. Performs two tasks: -

1. The watchdog monitors the Boolean heart beat from the remote device (PLC, HMI etc), on bit 15 of the Communication control word (73.70). If the bit does not change with the Watchdog Trip Delay Time (20.39) the Drive will trip (TR99).

2. Generate a Boolean heartbeat to Remote device with bit 15 of the status word (72.70), the Boolean heartbeat clock time define in parameter 20.38.

20.38	Watchdog Clock time
Coding	RW, U
Range:	1 – 32000
Units:	0.01 seconds
Default:	50

The time set is half the symmetrical clock time and is used for the Drives communications heartbeat to the remote device (PLC, HMI etc).

20.39	Watchdog Trip Delay
Coding	RW, U
Range:	1 – 32000
Units:	0.1 seconds
Default:	20

This delay defines the maximum time for the incoming heartbeat from the remote device to change state, before the drive will trip with loss of communications (TR99). This should be set according to the network traffic and update with enough margin to reduce spurious tripping.

20.40	Override Enable
Coding	RW, B
Default settings:	0

When set this will enable the override function, which will override the assist Start & Stop delays (18.21 & 18.23) with the override delay (18.24) when the process error (18.05) exceeds the Override symmetrical threshold (20.41). This is useful to maintain closer control where the peak demand increases/decreases dramatically and the assists are required to be called for starting/stopping more quickly.

20.41	Override Symmetrical Threshold
Coding	RW, U
Range:	18.14 – 18.12
Units:	EGU
Default:	10

This defines the symmetrical threshold around the process error (18.05) for Start/stop delays (18.21 & 18.23), to be overwritten with the Override delay (18.24). This is only active when Override Enable parameter, (20.40) is set.

20.42	Process Preset Set-point 2
Coding	RW, U
Range:	18.14 to 18.12
Units:	EGU
Default settings:	100

This is an optional process preset set point that can be selected alternatively to he main parameter preset set point (18.11). This is can be selected by disabling analogue set-point enable parameter (18.37 = 0) and setting the Process Preset Set point 2 Select parameter (18.32 =1). This parameter can be set locally from the Unidrive keypad or written to remotely via serial communication.

20.49	Application Software Version
Coding	R0, U

This indicates the current duty assist application software version used within the application module.

The parameter version is displayed as an integer value for example, 10208 denotes V01.02.08.

7.2.5   Internal PLC Registers

The non-volatile 70.90 to 70.99 (P registers), have been reserved for this application software.

8 Troubleshooting

8.1 Unidrive

Refer to Unidrive documentation for Unidrive and option module trip codes.

8.2 Application

8.2.1 Trip Codes

Trip Number	Description	Trip Enable Parameter
Tr80	Low Feedback Threshold Exceeded	19.21 & 18.35
Tr81	High Feedback Threshold Exceeded	19.20 & 18.35
Tr82	Low Flow on Duty Starter	18.36
Tr83	Total Starter failure	N/a
Tr84	Duty Contactor opened while drive running	N/a
Tr85	Error with setting Terminal Defaults.	N/a
Tr98	Communication Remote Trip	N/a
Tr99	Communication Watchdog Trip	20.37

8.2.2 Alarm Indication

Alarm Parameter	Description	Enable Parameter
19.39	Low process feedback threshold exceeded	18.35
19.40	Low-Low process feedback threshold exceeded	18.35
19.41	High process feedback threshold exceeded	18.35
19.42	High-High process feedback threshold exceeded	18.35
19.38	No Flow occurred on one of the starters	18.36
20.40	Order of each starter that had no flow	18.36
19.22	Assist failed to start	
19.17	Order of each starter that failed to start	
19.32	Global Assist failed to start.	
20.29-32	Starts per hour counters	19.31

8.2.3 Fault Reset

The 'system reset' must be used to reset the Duty-Assist system from one of the following fault condition: -

1. Drive Trip (TrXX)
2. Assist fail-to-start
3. No Flow

A system reset can be achieved by performing one of the following methods: -

1. When terminal 2 default mode is selected (19.25 =1), closed input on term 27.
2. No terminal allocation, set parameter 18.50 = 1.
3. Serial communications set bit 6 of the control word parameter 73.70.
4. Alternatively power OFF and ON the Duty Unidrive.

NOTE

The standard drive reset pushbutton will only reset drive trips. The no-flow and assist fail-to start failures will lock out the availability of the respective starter, within the application module software. Therefore to reset these conditions the 'system reset' is required.

9   Advanced Features

9.1   Serial Communications

9.1.1   Control Word

Introduction

The fieldbus control word is an efficient way of remotely controlling the motion of a Drive. Due to the restriction of most fieldbus word length the control word length will be no more than 16bits, UD70/MD29 PLC register _S70%, (parameter 73.70) will be used to ensure full resolution is maintained (e.g. drive parameter limited to 32000 or 1000).

Standard

Each bit in the fieldbus control word has a particular function, and provides a method of controlling the output functions of the Drive (RUN, RESET, TRIP, etc.) with a single data word, (16Bits).

b15	b14	b13	b12	b11	b10	b9	b8
Wdin	Application Dependant					Preset 2 Select	SAVE

b7	B6	b5	b4	b3	b2	b1	b0
TRIP	RESET	AUTO	MASK	Reserved	Reserved	RUN FWD	ENABLE

To use the fieldbus control word, the ENABLE terminal on the drive must be closed, and the MASK bit must be set to 1. The 0-1 transition of the MASK bit will cause the digital I/O control to be switched from local terminal mode to fieldbus control.

When the MASK bit is reset to 0, the Digital I/O control is switched terminal control mode.

A selector switch can also be used to select between local (terminal) and remote (fieldbus) control of the Drive. If a digital input is configured to directly control mode parameter assigned 18.42, the value written by the Main Title interface will be immediately overwritten by the digital input.

Control Word - _S70% (Parameter 72.70)

Bit	Function	Description
0	ENABLE	Must be set to 1 to put the Commander SE in READY mode. Resetting to 0 will immediately disable the Drive, and the motor will coast to stop.
1	RUN FWD	Set to 1 (with ENABLE set to 1) to run the motor in the forward direction. When reset to 0, the Commander SE will decelerate the motor to a controlled stop before the outputs disabled
2	Reserved	
3	Reserved	
4	MASK	A 0-1 transition of this bit will set 18.42 to 1 to enable fieldbus control of the Drive. 18.42 can subsequently be over-written by a digital input if a Local – Remote (terminal or fieldbus), control selector switch is required. (A 1-0 transition will reset 18.42 to 0.)
5	AUTO	A 0-1 transition of this bit will set 18.41 to 1 to enable fieldbus control of the Drive. 18.41 can subsequently be over-written by a digital input if a Auto-Man (PID or speed), control selector switch is required. (A 1-0 transition will reset 18.41 to 0.)
6	RESET	A 0-1 transition will reset the Unidrive from any trip condition. If the cause of the trip has not been cleared, the Drive will trip again immediately. The mask bit does not required to be set to use this control bit function.
7	TRIP	A 0-1 transition will force a "tr98" trip on the Unidrive. If the RESET and TRIP bits change from 0 to 1 on the same cycle, the TRIP bit will take priority. The mask bit does not required to be set to use this control bit function.
8	SAVE	A 1-0 (-ve edge), transition will save all the Unidrive parameters (Menus 0 –19), and all the application parameters (Menu 20 & internal PLC menus 70 &71). The parameter save can only be performed while the drive/system is stopped. Note: The Application module will be reset during a parameters save.
9	Preset 2 select	A 0-1 transition of this bit will set 18.32 to 1 to select Process Preset Set point 2 (20.40). 18.32 can subsequently be over-written by a digital input this will have priority. A 1-0 transition will reset 18.32 to 0.
9-14	Reserved	

| 15 | WDin | Watchdog In Comms clock from remote device. The mask bit does not required to be set to use this control bit function. |

When a Drive trip occurs, the Drive automatically sets the Drive control word to 0 when reset. This ensures that, for safety reasons, the Drive does not start up immediately when it is reset.

The recommended control method for the PLC program is to reset the fieldbus control word to a safe state, e.g. Drive disabled, when a fault is detected in either the Application software, (The Drive control word is reset to 0 automatically when the Drive resets from a trip.) When the Serial Communication link is healthy again, the appropriate fieldbus control word can be set, a change of fieldbus control is detected, the Drive control word will be updated and the Drive will restart. Some example fieldbus control word values to control the Drive are given in the table below.

Wdin is the communication watchdog bit transmitted from remote intelligent device, (keypad or CTIU, etc).

Control Word (Hex)	Control Word (Dec)	Action
0x0000	0	Control word disabled, Drive will operate under terminal control
0x0010	16	Drive disabled
0x0011	17	Drive enabled and stopped
0x0013	19	Drive enabled and run forwards
0x0080	128	Trip Drive
0x0040	64	Reset Drive

9.1.2 Status Words

The status word returns the status of multiple functions with the Duty-Assist system, e.g. at speed, zero speed, Drive healthy, etc., and provides a quick method of checking the current status remotely with serial communication.

Status Word1 - _R70% (Parameter 72.70)

b15	b14	b13	b12	b11	b10	b9	b8
WDout	19.50	19.49	19.48	19.47	19.46	19.45	19.44

b7	b6	b5	b4	b3	b2	b1	b0
19.43		18.42	18.41	Inh.	10.03	10.02	10.01

Bit	Parameter	Description
0	10.01	Duty drive healthy
1	10.02	Duty drive running
2	10.03	Duty drive at zero speed
3	8.07 & 06.15	Duty drive Enabled (Ready)
4	18.41	Auto control Selected
5	18.42	Remote digital control Selected
6		Sleeping
7	19.43	Starter 1 Available
8	19.44	Starter 1 Running
9	19.45	Starter 2 Available
10	19.46	Starter 2 Running
11	19.47	Starter 3 Available
12	19.48	Starter 3 Running
13	19.49	Starter 4 Available
14	19.50	Starter 4 Running
15	WDout	Watchdog out Comms. Clock

Wdout is the communication watchdog bit transmitted from the UD70/MD29 to a remote intelligent device, (keypad or CTIU, etc).

Status Word 2 - _R71% (Parameter 72.71)

b15	b14	B13	b12	b11	b10	b9	b8
WDout							
B7	**B6**	**B5**	**b4**	**B3**	**b2**	**b1**	**b0**
				19.42	19.41	19.40	19.39

Bit	Parameter	Description
0	19.39	Process Feedback Low Alarm
1	19.40	Process Feedback Low-Low Alarm
2	19.41	Process Feedback High Alarm
3	19.42	Process Feedback High-High Alarm
4		Starter 1 Starts per Hours failure
5		Starter 1 Fail to Start failure
6		Starter 1 No Flow failure
7		Starter 2 Starts per Hours failure
8		Starter 2 Fail to Start failure
9		Starter 2 No Flow failure
10		Starter 3 Starts per Hours failure
11		Starter 3 Fail to Start failure
12		Starter 3 No Flow failure
13		Starter 4 Starts per Hours failure
14		Starter 4 Fail to Start failure
15		Starter 4 No Flow failure

Status Word 3 - _R72% (Parameter 72.72)

b15	b14	B13	b12	b11	b10	b9	b8
b7	**B6**	**B5**	**b4**	**B3**	**b2**	**b1**	**b0**
		Preset 2	Duty4	Duty3	Duty2	Duty1	Cycle

Bit	Parameter	Description
0		Starters are being Cycled
1		Starter 1 is selected as Duty
2		Starter 2 is selected as Duty
3		Starter 3 is selected as Duty
4		Starter 4 is selected as Duty
5	18.32	Process Preset Set point 2 selected
6		
7		
8		
9		
10		
11		

NOTE

Resetting from a fault of performing a parameter save will clear the status word for a short period of (approx 0.7 seconds), while the application module reinitialises.

10 CTIU – Operator Panel

10.1 Introduction

The CTIU operator interface enables the user to monitor, set-up and control the Duty Assist application remotely without the need to use the manual or Unidrive parameter numbers. All parameters are displayed in text rather than using it's Unidrive parameter number. Textual descriptions are also given for trips/alarms, Boolean statuses/settings and selection parameters. On line Help descriptions are available for further information on the configuration parameters.

Front View of CTIU110
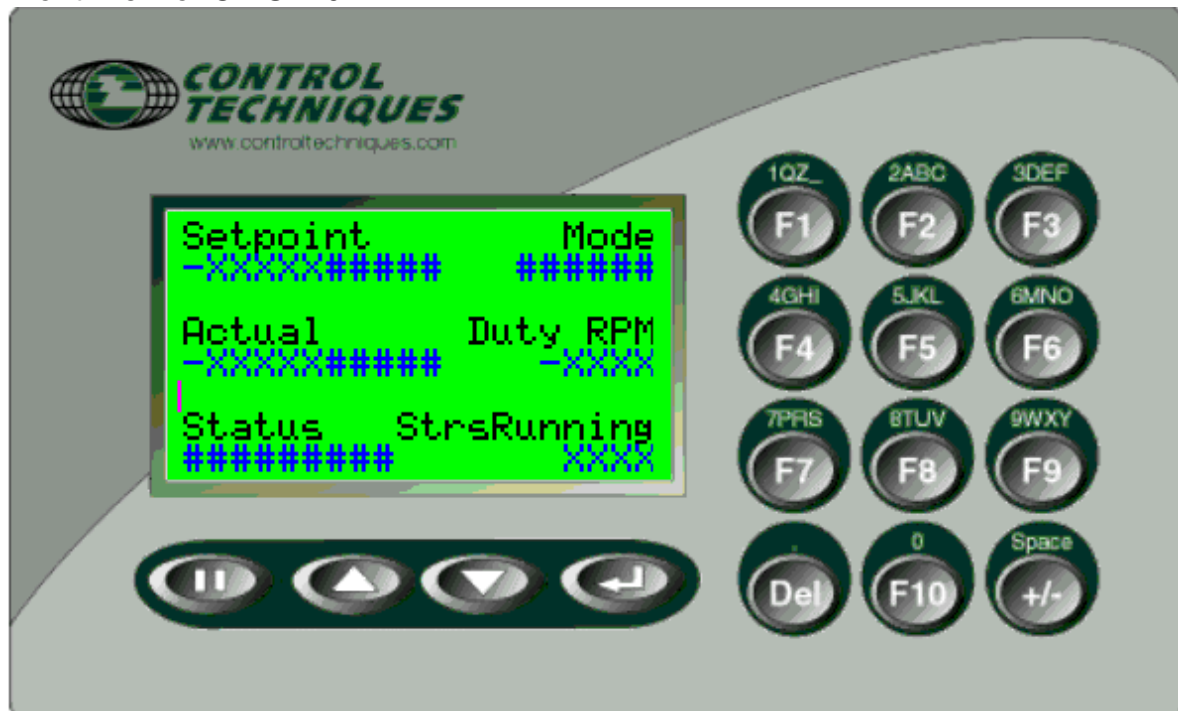
10.2 Software Version

CTIU Software Version – V01.00.00 or greater, this will be displayed on the CTIU second splash screen or can be found under the 'Drive Diagnostics' menu

10.3   Mechanical Installation

10.3.1 Panel Cut-out Detail

5.95" [151mm]

$3.27"^{+0.02}_{-0.00}$ [$83^{+0.5}_{-0.0}$ mm]

UP TO 0.04"[1mm] CORNER
RADIUS IS ACCEPTABLE
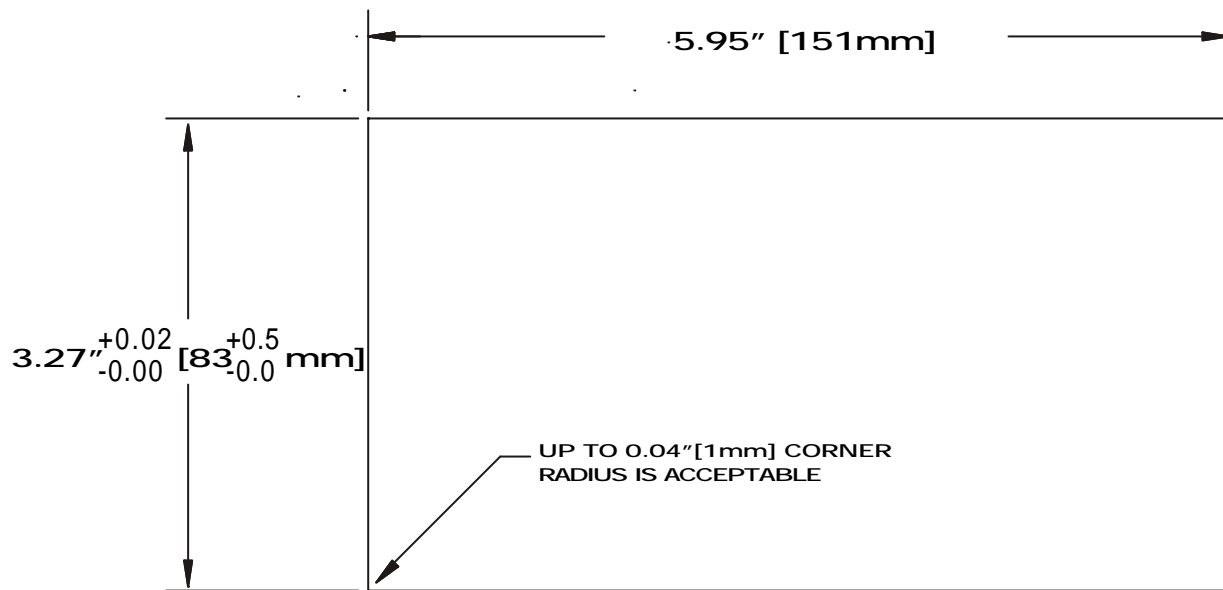
CTIU11X CUTOUT DETAILS

TOLERANCES ARE +/- 0.01" [0.3mm] UNLESS STATED OTHERWISE

10.4   Electrical Installation

10.4.1   CTIU110 Rear View
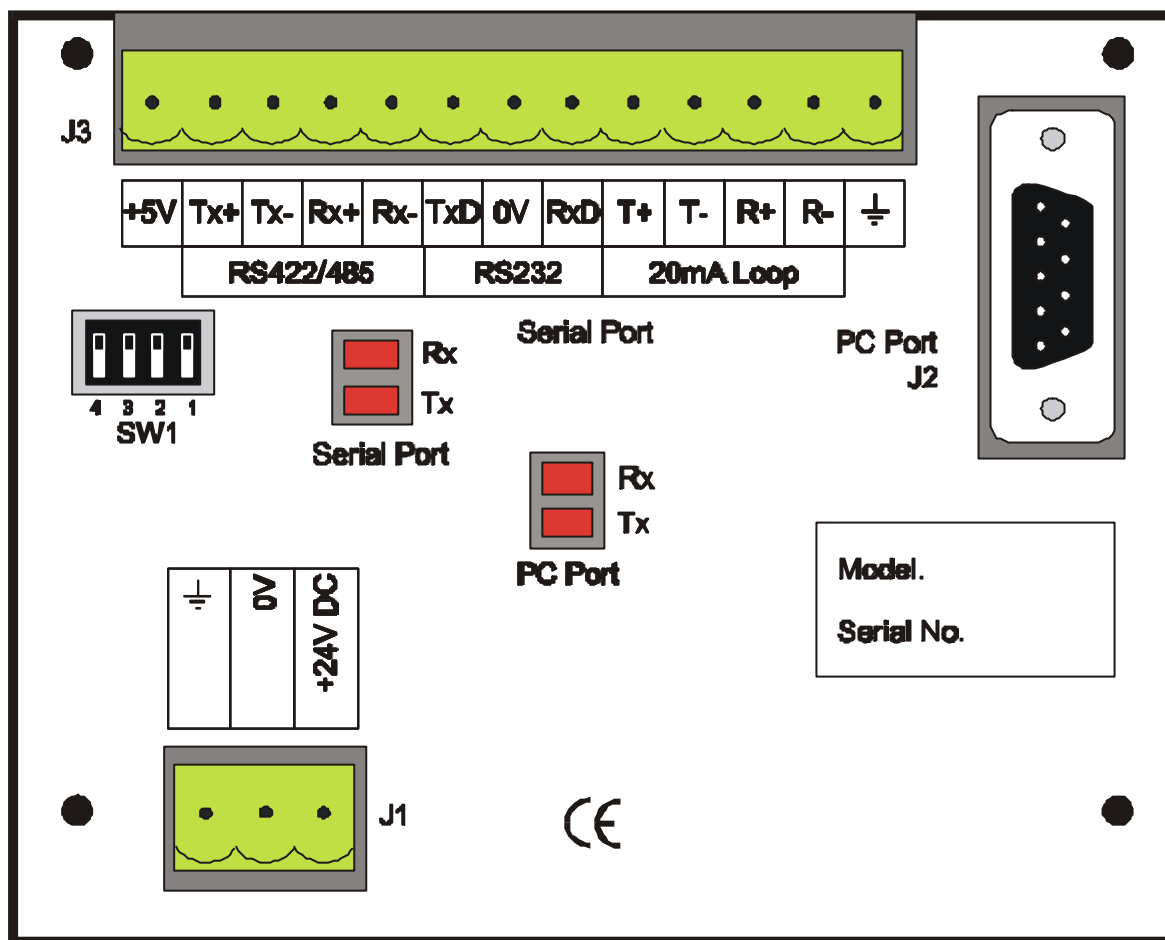
24Vdc Power Supply Requirements (J1)
Peak Inrush – 240mA
Continuous – 100mA

10.4.2 Serial Communications Cable Connections

Unidrive Application Module

RS232 Port   RS485 Port

D-type male Connector

7	3	6	2	1

Twisted Pairs with overall screen

0.1MicroF Ceramic

2	3	4	5	6	7	8
Tx+	Tx-	Rx+	Rx-	TxD	0v	RxD
RS422/485				RS232		

Section of 13 pin connector
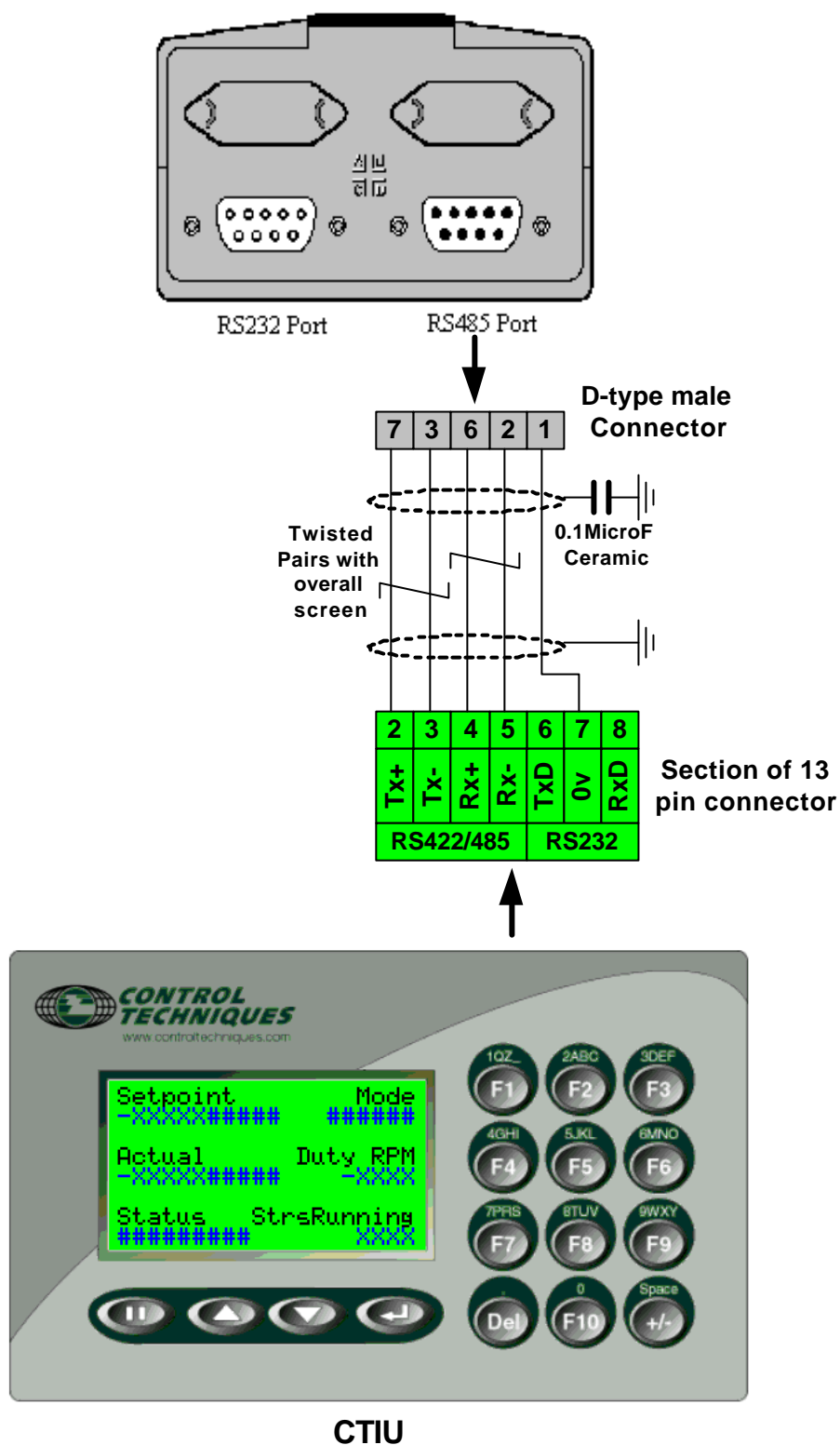
CTIU

Recommended Cables
Belden No. 8105, 9807 or 9832 – General Purpose
Belden No. 8165 – Heavy Noise Environment

10.5 Unidrive set-up

The protocol used between the CTIU110 and the Unidrive applcation module is Modbus RTU. To establish comunications the Unidrive Address, Baud rate and Protocol is required to be set, the following table details the required parameters to be set: -

Parameter	Setting	Description
17.05	11	Drive address
17.06	13	RS458 Modbus-RTU protocol mode
17.07	9600	Baud rate

Perform a Drive save to save these setting during power down.

e.g. XX.00 = 1000 followed by reset.

10.5.1 CTIU110 Configuration of the RS-485 Port
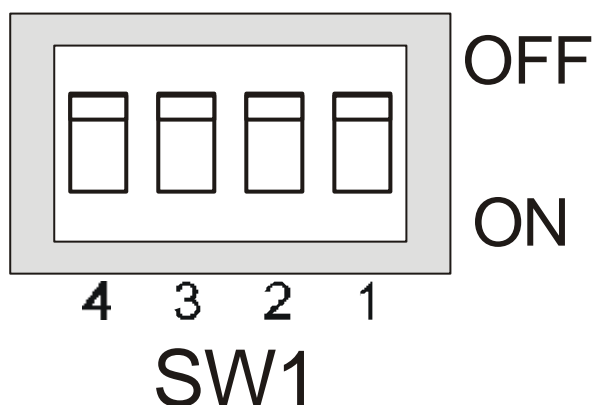
Configuration Bank

The configuration bank sets the parameters of the RS-485 port as described in Table 4.1.

Configuration Bank Description	
Switch 1	ON: Pull-up (must be used together with switch 3) OFF: no Pull-up
Switch 2	ON: 120Ω termination OFF: no termination
Switch 3	ON: Pull-down (must be used together with switch 1) OFF: no Pull-down
Switch 4	Reserved for future use
NOTE: Switch 1 and 3 must be used together. Either both pull-up and pull-down are used or neither is used.	

Pull-up and **Pull-down** switches are used to increase the signal level on the RS-485 bus. This is useful if there is a long bus and a significant amount of attenuation is anticipated.

Termination resistance of 120Ω must be placed across each end of the RS-485 bus. With switch 2 ON, a 120Ω resistance is placed across the bus. This should only be used if the CTIU050/100/110 is the last device at either end of the bus.

10.6   Operation Button Selection Actions

PAUSE key selects data for editing OR exits from data editing.
PAUSE & DOWN keys pressed together, enters sub menu pages.
PAUSE & UP keys pressed together, exits sub menus to the parent menu pages.
UP key selects the previous menu page, sub menu page, alarms, and increments data
DOWN key selects the next menu page, sub menu page, alarms and also decrements data.
ENTER key sends data to the automation equipment, accepts alarms, and displays accepted alarms.
ALPHANUMERIC KEYPAD and **PROGRAMMABLE KEYS** can be used to enter data or can be used to preform some pre-programmed action.

Contrast Adjustment

On menu page 1 (after the start-up screen), hold the ENTER key and press the UP or DOWN key to adjust the contrast. The contrast setting is stored and not lost after removing power.

10.7   Navigation

The Duty assist screens are split into 2 sections: -

- Operator section
- Configuration section

The Duty Assist parameters are grouped into relevant application menus to aid with efficient navigation to each parameter. Each menu has two parts,

A parent menu page, this is the menu header and displays the menu description.

Sub-menu page/s containing all the relevant parameters for the menu.

e.g. Parent Menu Page: I/O Diagnostics

Sub-menu Pages contain relevant parameter for the Parent Menu: -

All status of the Digital Inputs and Outputs Terminals: 1&2, 24-30 and 40-50.

The current values on all Analogue input terminal: 05-08 and 51-52.

Using on-screen graphical icons the following sections describes how to navigate between Parent and sub-menu screens.

10.7.1 Parent Menu Pages Navigation

Parent Menu Page Down
This signifies the parent menu navigation direction. When this symbol is shown, pressing the 'Down' key will display the next parent menu page down from the current.

Parent Menu Page UP
This signifies the parent menu navigation direction. When this symbol is shown, pressing the 'Up' key will display the next parent menu page up from the current.

Sub-menu Access
This indicates the two key that need to be pressed to access the Parent sub-menu.
e.g. to access the Process Diagnostic sub-menu pages, press the Pause and Down keys together.
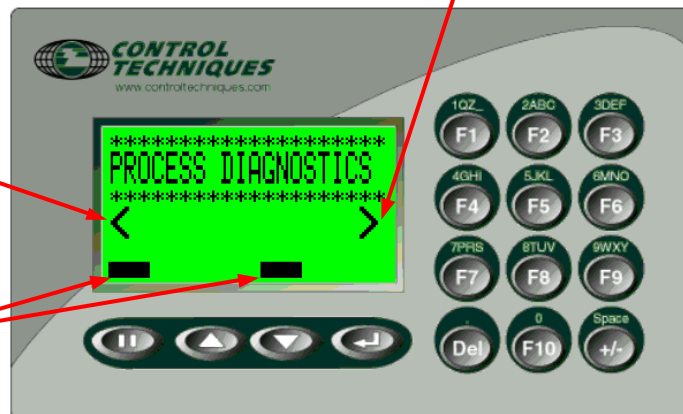
10.7.2 Sub-menu Pages Navigation

Help
All the configuration sub-menu pages are provided with a brief help description for each parameter. Pressing the F10 key will display the help information for the parameters displayed on the current sub-menu page .

Parent Menu Access
Press the Pause and the Up keys together to go back to the Parent menu page. This will be indicated on the last page on each sub-menu
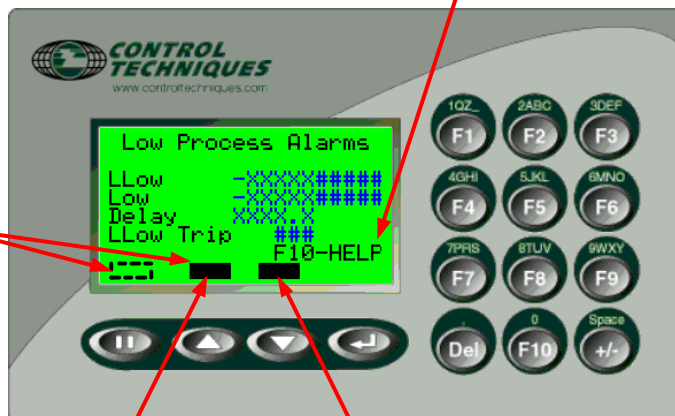
Sub-menu Page UP
This signifies the sub-menu navigation direction. When this symbol is shown, pressing the 'Up' key will display the next sub-menu page up from the current.

Sub-menu Page Down
This signifies the sub-menu navigation direction. When this symbol is shown, pressing the 'Down' key will display the next sub-menu page down from the current.

10.8 Operators Screens Description

The operator screens consist of: -

- Top-level main page which provides an overview of all the important parameters of the process on one screen
- Diagnostic information for Process, starters, drive and I/O.
- Process set points.

These screens are detailed in the Operators navigation diagram shown below.

10.8.1 Top Level Screen and Functionality
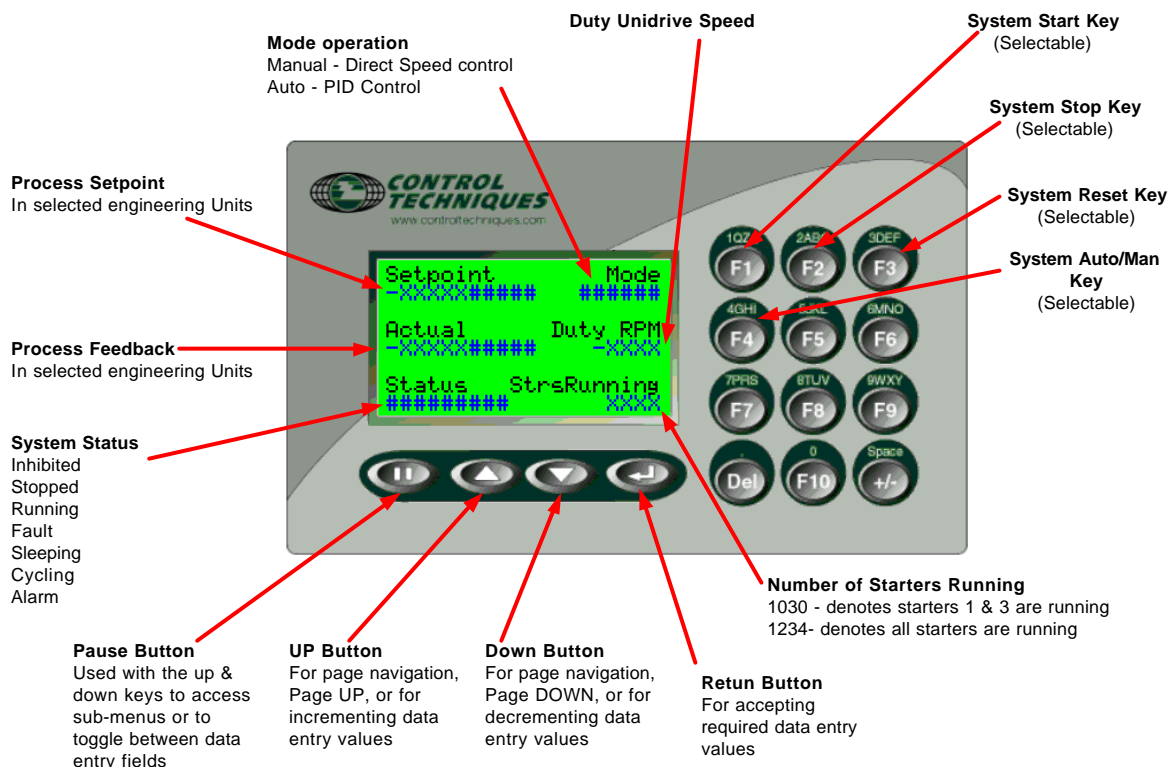
The top-level screen indicates all the common variables for process/application, e.g. set points, feedbacks, status etc. The Top level screen is always the first menu Page to be displayed. A Menu Timeout, safety feature is used to force the CTIU display focus back to the first (main) menu page after a set time period. The Menu Timeout period is set to 120second (2mins).

10.8.2 Process Set points

The process set point menu is password to restrict access to unauthorised personnel.

The password to access the set point menu is 5555.

Auto mode

Process Set points 1 & 2 (Day & Night).

Manual mode

Frequency Set point

10.8.3 Diagnostic Screens

The following diagnostic screens are available: -

Process Diagnostics

Displays parameters directly related to the process control, Feedback alarm thresholds; Feedback; Current alarm status.

Starter Diagnostics

Displays parameters directly related to each starter, Running Status; Availability Status; SPH, No Flow, Fail to Start Alarms; Runtime; Selected Duty Starter when in flexible duty mode.

Drive Diagnostics

Displays parameters directly related to the Duty drive, Frequency, Volts, Power, Speed, DC Bus Volts, Current, Overload accumulator; Fault log; Software versions.

I/O Diagnostics

Displays parameters directly related to the Duty drive inputs & outputs, Unidrive standard and option digital status's and analogue current values.

Operator Navigation

MAIN PAGE

MAIN PAGE
```
Setpoint        Mode
-XXXXX#####    ######
Actual       Duty RPM
-XXXXX#####      -XXXX
Status    StrsRunning
#########        XXXX
```

PARENT MENU PAGES

```
*********************
PROCESS SETPOINT
*********************
<   Enter Password   >
         ????
```

```
*********************
PROCESS DIAGNOSTICS
*********************
<                    >
```

```
*********************
STARTERS DIAGNOSTICS
*********************
<                    >
```

```
*********************
DRIVE DIAGNOSTICS
*********************
<                    >
```

```
*********************
I/O DIAGNOSTICS
*********************
<                    >
```

```
*********************
CONFIGURATION
*********************
<   Enter Password   >
         ????
```

Sub-Menu (Process Setpoint)
```
Process Setpoint 1
          (Day)
-XXXXX#####
Range-XXXXX - -XXXXX
```
```
Process Setpoint 2
          (Night)
-XXXXX#####
Range-XXXXX - -XXXXX
```
```
MANUAL Freq. Ref.
-XXX.XHz
Range-XXX.X - -XXX.X
```

Sub-Menu (Process Diagnostics)
```
Process Alarms
####################
###############
```
```
| Process Alarms
         Status  Level
L-Low   #####  -XXXXX
Low     #####  -XXXXX
High    #####  -XXXXX
H-High  #####  -XXXXX
```
```
Process Feedback
    TREND & AXES
                  1min
```
```
   Time & Date
  31/08/01 12:00:09
This is only
available when
option is fitted.
```

Sub-Menu (Starters Diagnostics)
```
Selected Duty
    Starter
##########
```
```
| Starter 1 Status
##########  #######
##########  #######
SPH ###   #########
Count XXX    ET XXmin
```
```
Starter 2 Status
##########  #######
##########  #######
SPH ###   #########
Count XXX    ET XXmin
```
```
Starter 3 Status
##########  #######
##########  #######
SPH ###   #########
Count XXX    ET XXmin
```
```
Starter 4 Status
##########  #######
##########  #######
SPH ###   #########
Count XXX    ET XXmin
```
```
Starters Runtime
      Days   Hrs Mins
ST1  XXXXX    XX:XX
ST2  XXXXX    XX:XX
ST3  XXXXX    XX:XX
ST4  XXXXX    XX:XX
```

Sub-Menu (Drive Diagnostics)
```
Drive Diagnostics
Freq.      -XXX.XHz
Voltage       -XXXV
Power     -XXX.XXkW
Speed    -XXXXRPM
DC Bus        XXXV
```
```
Drive Diagnostics
Ires       -XXXX.XXA
Imag       -XXXX.XXA
O/L acc.      XXX.X%
```
```
Fault Log
Last
####################
2nd
####################
3rd
####################
```
```
Fault Log
4th
####################
5th
####################
6th
####################
```
```
Fault Log
7th
####################
8th
####################
9th
####################
```
```
CTIU - Drive
Communications
Good        XXXXXXXXX
Bad         XXXXXXXXX
No Comms    XXXXXXXXX
```
```
Software Versions
CTIU          X.XXXX
UD70 System   X.XX
Application   X.XXXX
Unidrive      X.XX.XX
```

Sub-Menu (I/O Diagnostics)
```
Standard Digital I/O
24 DI ### 28 DI ###
25 DI ### 29 DI ###
26 DO ### 30 DI ###
27 DI ### 1&2DO ###
```
```
Optional Digital I/O
40 DO ### 46 DI ###
41 DO ### 48 DI ###
44 DI ### 49 DI ###
45 DI ### 50 DI ###
```
```
Standard Analogues
05 AI -XXX.X%
07 AI -XXX.X%
08 AI -XXX.X%
```
```
Optional Analogues
51 AI -XXX.X%
52 AI -XXX.X%
```

Sub-Menu (Configuration)

Refer to the Configuration menu section

Navigation Arrow Description

➡ - Denotes navigation direction of the parent Menu pages.
This is achieved by using the up & down arrow keys on the CTIU.

➡ - Denotes navigation direction between the parent menu page & sub-menu pages. (without password).
To access the sub-menu from the parent menu page press the pause and the down arrow keys together.
To go back to the parent menu page from the submenu press the pause and the up arrow keys together.

➡ - Denotes navigation direction between the parent menu page & sub-menu pages. (with password).
This has the same functionality as the Blue arrow but a password is required before access to given to the sub menu.

➡ - Denotes navigation direction of the sub-menu pages.
This has the same functionality as the Black arrow.

10.9   Configuration Screens Description

The Configuration screens are a sub menu off the operator screens and it allows the user to set up the all the Duty-Assist system and respective drive parameters. All parameters and settings (where applicable) are displayed in text with additional on parameter Help (F10), therefore reducing the requirement for the use of the Help Manual.

The configuration menu is password protected to ensure no unauthorised personnel can effect the operation of the application by changing important parameters. The configuration password is different to the Process set point password as it is intended for a higher level of user (e.g. maintenance, service or commissioning engineer)

The password to access the Configuration menus is 9999.

The Configuration screens are made up of the following sub-menus:-

System Set-up

Main configuration parameter s for the Duty assist application: -

Number of starters/motors, Operation modes (flexible or fixed duty with runtime or sequence selection), Control modes (Auto/Man & Local/Remote)

Scaling & Units

Scaling of the process feedback signal range to Real Engineering Units.

Call Thresholds

Assist starters Start/Stop threshold parameters.

Start/Stop Thresholds, Start/Stop delays, Override feature, Transitional Delay.

PID

Process PID configuration parameters

Proportional-Integral-Differential Gains, Inverse Speed P rofile, PID always enable, PID output scalar, Set point Slew, Process signal source selection (set point, feedback speed ref.)

Process Protection

Process alarm thresholds and no-flow protection parameters.

High and Low alarm thresholds, delay and trip enables

No-Flow protection enable.

Starter Protection

Number of starts per hour protection configuration parameters for each fixed speed assist start.

Sleep/Wake Function

Sleep/Wake threshold parameters.

Sleep frequency threshold and delay, Wake process feedback threshold and delay, Wake below enable.

Optional Features

Optional configuration parameter for the Duty assist application and CTIU.

Cascade stopping, Runtime cycling, Day/Night feature, CTIU function key controls, Communication watchdog.

Ancillary

Configuration parameter for ancillary features for the Duty assist application

Terminal default mode, Default parameters, Duty & assists Runtime counter reset.

Motor Details

Duty drive motor map parameters.

Current, voltage, frequency, Number of poles, speed, Power factor.

Drive Settings

Applicable drive configuration parameters for the Duty-Assist applications.

Min & Max Frequency range, Current limit, Ramp rates, stopping mode, ramp mode, V-F profile, voltage mode, Switching frequency, Catch spinning motor set-up, Auto reset.

10.9.1 Parameter Help

A Help feature is provided for all configuration parameters, by pressing F10 function, (where displayed see section1.22) will give a brief description of the parameters currently displayed on the CTIU.

10.9.2 Day/Night Function

The CTIU with Real Time Clock option must be used when the Day/night function is required.

This feature uses the Process Preset Set point parameters, where the main process set point, (preset 1, parameter 18.11) is used for the daytime set point and the process preset set point 2, (20.42) is used for the night-time set point.

(Note: the Analogue Process Set point enable parameter 18.37, must be set to 0).

The Daytime start and end points are set on the CTIU configuration 'Optional Features' menu, page 2, when the clock time is within the Daytime start and end points, the daytime set point is used (preset set point 2 select parameter 18.32 = 0), and when the time is outside these points the night time set point is used (preset set point 2 select parameter 18.32 = 1).

Configuration Navigation

Parent Menu Pages

System Setup	Scaling & Units	Call Thresholds	PID	Process Protection	Starter Protection	Sleep/Wake Function	Optional Features	Ancillary	Motor Details	Drive Settings

Sub-Menus

System Setup Sub-Menu

Number of Starters
X Starters
F10-HELP

Control Mode
Remote Select ###
Auto Select ###
F10-HELP

Mode of Operation
F10-HELP

Sequence Order
XXXX
Only applicable for Modes 1 & 2.
F10-HELP

Scaling & Units Sub-Menu

User Units
#####
F10-HELP

Scaling
EGU High -XXXXX
TIU High -XXXXX
EGU Low -XXXXX
TIU Low -XXXXX
F10-HELP

Call Thresholds Sub-Menu

Assist Start/Stop Thresholds
Start Level -XXX.XHz
Start Delay XXXX.Xs
Stop Level -XXX.XHz
Stop Delay XXXX.Xs
F10-HELP

Start/Stop Delay Override
Enable ###
Delay XXXX.XSec
Level -XXXX#####
F10-HELP

Transitional Delay
XXXX.XSec
F10-HELP

PID Sub-Menu

PID Gains
Proportional XXXXX
Integral XXXXX
Differential XXXXX
F10-HELP

Feedback Response
TREND & AXES
1min
F10-HELP

PID Options
Inverse Speed ###
PID Always En. ###
PID Scalar XXXXX
SP Slew XXXXX#####/s
F10-HELP

Signal Sources
Process Ref ########
ProcessFbk ########
Speed Ref. ########
F10-HELP

Process Protection Sub-Menu

Process Alarms
###
F10-HELP

Low Process Alarms
LLow -XXXX#####
Low -XXXX#####
Delay XXXX.Xs
LLow Trip -XXXX#####
F10-HELP

High Process Alarms
HHigh -XXXX#####
High -XXXX#####
Delay XXXX.Xs
High Trip ###
F10-HELP

No Flow Protection
###
NoFlow Delay XXXX.Xs
F10-HELP

Starter Protection Sub-Menu

Starts Per Hour(SPH)
###
F10-HELP

Starters SPH
Starter 1 XXXXX
Starter 2 XXXXX
Starter 3 XXXXX
Starter 4 XXXXX
F10-HELP

Sleep/Wake Function Sub-Menu

Sleep/Wake Function
###
F10-HELP

Wake Settings
Wake -XXXX#####
Wake Delay XXXX.XSec
Wake Below ###
F10-HELP

Sleep Settings
Sleep -XXX.XHz
Sleep Delay XXXX.XSec
F10-HELP

Optional Features Sub-Menu

Optional Features
Cascade Stop ###
Runtime Cycle ###
Cycle Time XXXXXhrs
F10-HELP

Day/Night Feature
Enable ###
Daytime Start XXXX
Daytime End XXXX
03/09/01 13:07:14
F10-HELP

Comms. Watchdog
Enable ###
Clock time XXX.XSec
Trip Delay XXXX.XSec
F10-HELP

Keypad Controls
F1 Start ########
F2 Stop ########
F3 Reset ########
F4 Auto/Man ########
F10-HELP

Ancillary Sub-Menu

Terminal Setup
Ensure the system is stopped before selecting
F10-HELP

Default Application Parameters
Ensure the system is stopped and Press F8 key to perform this function
F10-HELP

Runtime Counters
F5 - Duty Reset
F6 - Starter 1 Reset
F7 - Starter 2 Reset
F8 - Starter 3 Reset
F9 - Starter 4 Reset
F10-HELP

Motor Details Sub-Menu

Motor Details
Current XXXX.XXAmps
Voltage XXXVolts
Frequency XXX.XHz
F10-HELP

Motor Details
No. of Poles ##
Speed XXXXRPM
P.F. X.XXX
F10-HELP

Drive Settings Sub-Menu

Drive Settings
Min. Freq. XXX.XHz
Max. Freq. XXX.XHz
ILimit XXX.X%
F10-HELP

Drive Ramp Setting
Accel XXXX.Xs/100Hz
Decel XXXX.Xs/100Hz
Mode #########
Stop mode #########
F10-HELP

Drive Settings
Dynamic V-F ###
Volts mode ###
Volts Boost XXX.X%
FREQSw ####kHz
F10-HELP

Catch Spinning Motor
Feature ###
Framp XX.Xs/100Hz
Voltage XX.X%
Vramp XX.XSec
F10-HELP

Drive Auto Reset
No of Resets X
Reset Delay XX.XSec
F10-HELP

Navigation Arrow Description

- Denotes navigation direction of the parent Menu pages. This is achieved by using the up & down arrow keys on the CTIU.

- Denotes navigation direction between the parent menu page & sub-menu pages. (without password).
To access the sub-menu from the parent menu page press the pause and the down arrow keys together.
To go back to the parent menu page from the submenu press the pause and the up arrow keys together.

- Denotes navigation direction between the parent menu page & sub-menu pages. (with password).
This has the same functionality as the Blue arrow but a password is required before access to given to the sub menu.

- Denotes navigation direction of the sub-menu pages. This has the same functionality as the Black arrow.

10.10 Splash Screens

There a two splash screens displayed in sequence during initial power up. These detail the application and software version information.

10.10.1 Application Page (1st Page)

10.10.2 Software Version Page (2nd Page)

10.11 Parameter Save

When any of the editable data fields has been changed within the configuration menus and the Top-level menu page (1) is display (due to timeout, or forced by the user), a parameter save will be prompted to the operator.

10.11.1 Parameter Save Main Screen
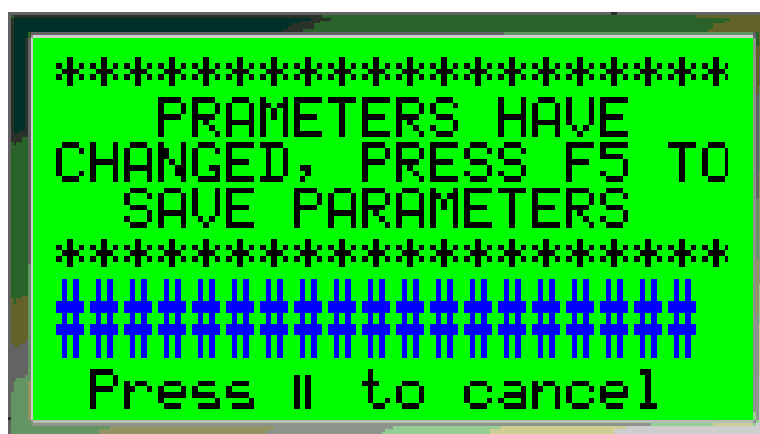
This is the first screen to be displayed, where it indicates to the user to save parameters by pressing Function key F5. To save the parameters the Duty Unidrive must be in stopped state, a flashing message will be displayed to advise if a save can be performed.

e.g. Flashing Message

Drive Running – Stop Drive to Save

Drive Stopped – OK to Save

If a parameter save is not required the pause (||) key can be press to quit back to the Top-level menu page (1).

10.11.2 Parameter Save Acknowledgement Screen

When function key F5 is press with the Drive stopped the above screen will appear acknowledging a parameter save is being performed. After approximately 5 seconds the top level menu page (1) will re-appear, confirming the save has completed.

10.12   Trip & Alarm indication

There are two types Alarm pages: -

- Trip – Indication the system has tripped and needs a reset to resume operation. (Unless the result of the trip has caused permanent damage)

- Alarm – Indication of non-critical alarms that will not stop the system but may restrict the operation, or advise the process is close to or on process limits.

Starter alarms will lock out the corresponding starter and make it unavailable for selection, these alarm require a reset to make the starter available again. Indication is given where a reset is required with an alarm.

All pages have to be acknowledged by the pressing of the 'Return' key. This will remove the Alarm page from the display only; this will not reset any trips or alarms on the drive. A trip or alarm reset is a separate function and can be performed from the CTIU (F3 key when feature is enabled), or from another source (Pushbutton, PLC, etc). When a trip or an alarm is acknowledged but not reset, the Alarm page will be removed from the display of the CTIU. To make the operator aware this is still a trip or an alarm still present, the top level menu page (1), 'Status' data field will indicate that the system has a 'Fault' or an 'Alarm' present. Pressing the 'Return' key while on the top-level menu page (1) will toggle between the Alarm page and the top-level menu page. The alarms and trips can also be review in the following 'Diagnostic Menus':

- Alarms – Process Diagnostics (page 1 of sub menu)
- Trips – Drive Diagnostics (Page 3 Last Fault logged)
-

10.12.1 TRIP Page (Alarm page 1)

Trip Description
Text table with reference to Unidrive parameter #10.20

Acknowledge
Press Return Key. This will not reset fault.

10.12.2 ALARM PAGE (Alarm page 2)

Alarm Description
Text table with reference to Internal variable %R0035

Acknowledge
Press Return Key. This will not reset alarms where requir

Reset Indication
This text will appear when a reset is required.
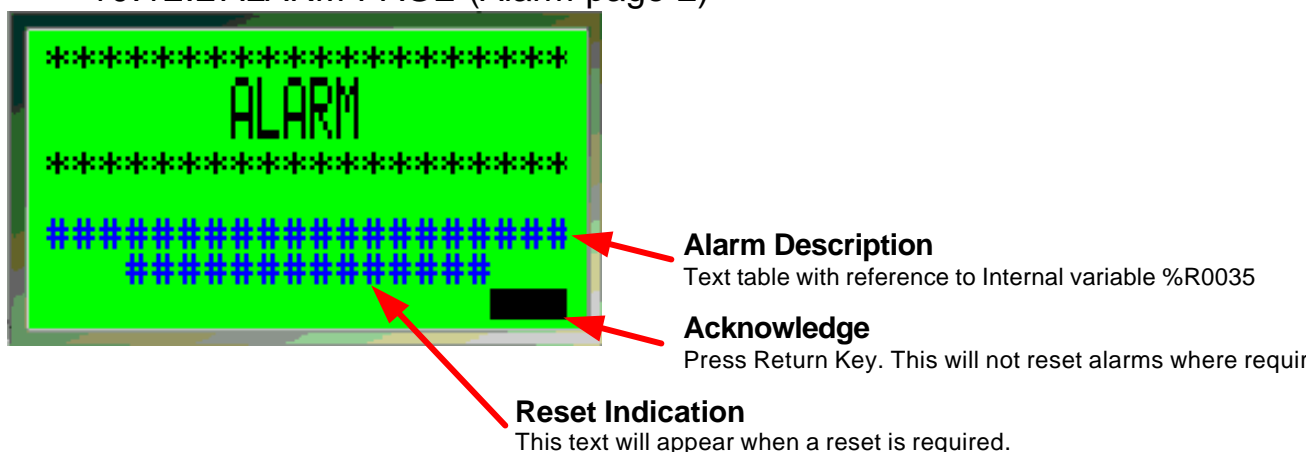
10.13   CTIU Function Keys Allocation

10.13.1 Global Control Function Keys

The following Function keys can be optionally configured from the Configuration 'Optional Features' menu. These functions allow the duty assist application to be fully controlled from the CTIU without the need for addition switchgear (switches, pushbuttons etc). These function keys, when selected, are active on every display focus and will control the application provide the 'Remote select 'parameter is set (18.42 =1): -

F1 – Start, sets bit 1 of the control word when the function key is enabled and pressed.

F2 – Stop, reset bits 1 of the control word when the function key is enabled and pressed.

F3 – Reset, sets bit 6 of the control word when function key is enabled and pressed and resets to zero when released (pushbutton type).

F4 – Auto/Man, toggles bit 5 of the control word when the function key is enabled and pressed.

NOTE:

When using the start/stop function keys to control the application it is advisable to enable the communications watchdog, so the drive trips 'TR99', when the communication is lost.

10.13.2 Local Function Keys

The following are defined as local function keys as they are only apply to one or range of pages.

- F10 – Call On-line help. This is only available in the configuration pages and provides information for each parameter displayed on the current page.

- F5 – Parameter Save. This is only available when the parameter save status page is displayed. When pressed will save the parameters within the drive and second processor.

- F8 – Page 2 of the Configuration 'Ancillary' menu. This will default the application parameter when pressed.

- F4 to F8 – Page 3 of the Configuration 'Ancillary' menu. These are allocated to reset the runtime counters when pressed: -
    - o   F5 – Duty Runtime reset.
    - o   F6 – Starter 1 Runtime reset.
    - o   F7 – Starter 2 Runtime reset
    - o   F8 – Starter 3 Runtime reset
    - o   F9 – Starter 4 Runtime reset

10.14   Unidrive

10.14.1 Relevant Parameter

01.01	Reference selected
01.06	Maximum Frequency Clamp
01.07	Minimum Frequency Clamp
01.10	Bipolar reference select
01.11	Reference enabled indicator
01.15	Preset selector
01.21	Preset Speed reference 1
02.01	Post ramp speed reference
02.04	Ramp mode
02.10	Acceleration Selector
02.11	Acceleration Rate
02.20	Deceleration Selector
02.21	Deceleration Rate
04.01	Motor current magnitude
04.07	Symmetrical Current Limit
05.01	Motor Frequency
05.02	Motor Voltage
05.03	Motor Power
05.04	Motor Speed
05.05	DC Bus Voltage
05.06	Motor rated Frequency
05.07	Motor rated Current
05.08	Motor rated Full load rpm
05.09	Motor rated Voltage
05.10	Motor rated Power Factor
05.11	Motor rated Voltage
05.12	Magnetising Current test Enable
05.13	Dynamic V/F select
05.14	Voltage Mode select
05.15	Voltage Boost
05.18	Switching Frequency
06.01	Stop mode selector
06.04	Sequencing Mode
06.09	Synchronize to a spinning motor
06.10	Spinning motor ramp rate
06.37	Spinning motor start voltage
06.38	Spinning motor voltage ramp
10.34	No. of auto reset attempts
10.35	Auto reset delay
11.23	Serial comms. address
11.24	Serial comms. mode selector
11.25	Serial comms. baud rate selector
11.26	Serial comms. two wire mode delay selector

10.14.2 I/O Parameters
Standard Unidrive I/O

No.	Description	Term.
07.01	Analogue Input 1 Indication	5 & 6
07.02	Analogue Input 2 Indication	7
07.03	Analogue Input 3 Indication	8
07.06	Analogue input 1 mode selector	
07.08	Analogue input 1 scaling	
07.09	Analogue input 1 invert	
07.10	Analogue input 1 destination	
07.11	Analogue input 2 mode selector	
07.12	Analogue input 2 scaling	
07.13	Analogue input 2 invert	
07.14	Analogue input 2 destination	
07.15	Analogue input 3 mode selector	
07.16	Analogue input 3 scaling	
07.17	Analogue input 3 invert	
07.18	Analogue input 3 destination	
07.19	Analogue output 1 source	9
07.20	Analogue output 1 scaling.	
07.21	Analogue output 1 mode selector	
07.12	Analogue output 2 source	10
07.23	Analogue output 2 scaling.	
07.24	Analogue output 2 mode selector	
08.01	Digital input / output F1 state indicator	24
08.02	Digital input / output F2 state indicator	25
08.03	Digital input / output F3 state indicator	26
08.04	Digital input F4 state indicator	27
08.05	Digital input F5 state indicator	28
08.06	Digital input F6 state indicator	29
08.07	External trip / inhibit input state indicator	30
08.08	Relay 1 output indicator	1 & 2
08.09	External trip / inhibit input mode select	
08.10	F1 destination or source parameter	
08.11	F1 Invert	
08.12	F1 output enable	
08.13	F2 destination or source parameter	
08.14	F2 Invert	
08.15	F2 output enable	
08.16	F3 destination or source parameter	
08.17	F3 Invert	
08.18	F3 output enable	
08.19	F4 destination or source parameter	
08.20	F4 Invert	
08.21	F5 destination or source parameter	
08.22	F5 Invert	
08.23	F6 destination or source parameter	
08.24	F6 Invert	
08.25	Relay 1 source	
08.26	Relay 1 output Invert	
08.27	Positive logic select	

Additional I/O SOM

No.	Description	Term.
16.02	Relay 2 output indicator	40-42
16.03	Relay 3 output indicator	41-42
16.04	Analogue input 4 level	51
16.05	Analogue input 5 level	52
16.07	Digital Input / Output F7 state indicator	48
16.08	Digital Input / Output F8 state indicator	49
16.09	Digital Input / Output F9 state indicator	50
16.10	Digital Input F10 state indicator	44
16.11	Digital Input F11 state indicator	45
16.12	Digital Input F12 state indicator	46
16.13	Analogue input 4 scaling	
16.14	Analogue input 4 invert bit	
16.15	Analogue input 4 destination	
16.16	Analogue input 5 scaling	
16.17	Analogue input 5 invert bit	
16.18	Analogue input 5 destination	
16.19	Analogue Output 3 source	54
16.20	Analogue output 3 scaling	
16.21	F7 destination or source parameter	
16.22	F7 Invert	
16.23	F7 output enable	
16.24	F8 destination or source parameter	
16.25	F8 Invert	
16.26	F8 output enable	
16.27	F9 destination or source parameter	
16.28	F9 Invert	
16.29	F9 output enable	
16.30	F10 destination parameter	
16.31	F10 Invert	
16.32	F11 destination parameter	
16.33	F11 Invert	
16.34	F12 destination parameter	
16.35	F12 Invert	
16.36	Relay 2 source	
16.37	Relay 2 output Invert	
16.38	Relay 3 source	
16.39	Relay 3 output Invert	
16.40	Logic input polarity	

10.15   Application

10.15.1 Menu 18

No.	Description	Type	Units	Range	Default	Setting
18.01	Process Feedback	RO	TIU	0-32000	-	
18.02	Process Feedback Selected	RO	EGU	18.14-18.12	-	
18.03	Process Set point Selected	RO	EGU	18.14-18.12	-	
18.04	Manual Speed Set point Selected	RO	0.1Hz	01.07-01.06	-	
18.05	Process PID Error	RO	EGU	18.14-18.12	-	
18.06	Start Assist Request	RO	Bit	-	-	
18.07	Stop Assist Request	RO	Bit	-	-	
18.08	Duty Only Running	RO	Bit	-	-	
18.09	Sleep Initiated	RO	Bit	-	-	
18.10	Wake Initiated	RO	Bit	-	-	
18.11	Process Preset Set point 1	RW	EGU	18.14-18.12	500	
18.12	Feedback Scaling EGU High Value	RW	EGU	-/+32000	1000	
18.13	Feedback Scaling TIU High Value	RW	TIU	-/+32000	4000	
18.14	Feedback Scaling EGU Low Value	RW	EGU	-/+32000	0	
18.15	Feedback Scaling TIU Low Value	RW	TIU	-/+32000	0	
18.16	Process Set point Slew Rate	RW	EGU/s	0-32000	0	
18.17	PID Proportional Gain	RW	0.01Kp	0	100	
18.18	PID Integral Gain	RW	0.1Ki	0	50	
18.19	PID Differential Gain	RW	0.1Ki	0	0	
18.20	Start Assist Threshold	RW	0.1Hz	01.07-01.06	450	
18.21	Start Assist Delay	RW	0.1sec	0-32000	100	
18.22	Stop Assist Threshold	RW	0.1Hz	01.07-01.06	100	
18.23	Stop Assist Delay	RW	0.1sec	0-32000	100	
18.24	Override Delay	RW	0.1sec	0-32000	20	
18.25	Sleep Threshold	RW	0.1Hz	01.07-01.06	200	
18.26	Sleep Delay	RW	0.1sec	0-32000	100	
18.27	Wake Threshold	RW	EGU	18.14-18.12	210	
18.28	Wake Delay	RW	0.1Hz	0-32000	100	
18.29	Mode Select	RW	-	1-4	1	
18.30	Number of Starters	RW	-	1-4	4	
18.31	Inverse Speed Profile Enable	RW	Bit	-	0	
18.32	Process Preset Set point 2 Select	RW	Bit	-	0	
18.33	Sleep/Wake Enable	RW	Bit	-	0	
18.34	Wake Below Enable	RW	Bit	-	0	
18.35	Process Feedback Alarms Enable	RW	Bit	-	0	
18.36	No Flow Protection Enable	RW	Bit	-	0	

18.37	Analogue Process Set point Enable	RW	Bit	-	1	
18.38	Analogue Process Feedback Enable	RW	Bit	-	1	
18.39	Analogue Speed Set point Enable	RW	Bit	-	1	
18.40	System Run	RW	Bit	-	0	
18.41	System Auto Select	RW	Bit	-	1	
18.42	Remote Select	RW	Bit	-	0	
18.43	Cascade Stop Enable	RW	Bit	-	1	
18.44	PID Always Enable	RW	Bit	-	0	
18.45	Starter 1 Enable	RO	Bit	-	-	
18.46	Starter 2 Enable	RO	Bit	-	-	
18.47	Starter 3 Enable	RO	Bit	-	-	
18.48	Starter 4 Enable	RO	Bit	-	-	
18.49	Cycle Enable	RW	Bit	-	0	
18.50	System Reset	RW	Bit	-	0	

10.15.2 Menu 19

No.	Description	Type	Units	Range	Default	Setting
19.01	Duty Runtime Hours & Minutes	RO	HHMM	0-2359	-	
19.02	Duty Runtime Days	RO	Days	0-32000	-	
19.03	Starter 1 Runtime Hours & Minutes	RO	HHMM	0-2359	-	
19.04	Starter 1 Runtime Days	RO	Days	0-32000	-	
19.05	Starter 2 Runtime Hours & Minutes	RO	HHMM	0-2359	-	
19.06	Starter 2 Runtime Days	RO	Days	0-32000	-	
19.07	Starter 3 Runtime Hours & Minutes	RO	HHMM	0-2359	-	
19.08	Starter 3 Runtime Days	RO	Days	0-32000	-	
19.09	Starter 4 Runtime Hours & Minutes	RO	HHMM	0-2359	-	
19.10	Starter 4 Runtime Days	RO	Days	0-32000	-	
19.11	Low Alarm Threshold	RW	EGU	18.14-18.12	100	
19.12	Low-Low Alarm Threshold	RW	EGU	18.14-18.12	50	
19.13	Low Alarm Delay	RW	0.1sec	0-32000	100	
19.14	High Alarm Threshold	RW	EGU	18.14-18.12	900	
19.15	High-High Alarm Threshold	RW	EGU	18.14-18.12	1000	
19.16	High Alarm Delay	RW	0.1sec	0-32000	100	
19.17	No Flow Delay	RW	0.1sec	0-32000	100	
19.18	Transition Delay	RW	0.1sec	0-32000	100	
19.19	Starter Sequence	RW	-	1234-4321	1234	
19.20	Process Feedback High Trip Enable	RW	Bit	-	0	
19.21	Process Feedback Low Trip Enable	RW	Bit	-	0	
19.22	Assist Fail to Start Trip Indication	RO	-	1234-4321	-	
19.23	Starter No Flow Trip Indication	RO	-	1234-4321	-	
19.24	Parameter Defaults Enable	RW	Bit	-	0	
19.25	Terminal I/O Select	RW	-	0-2	0	
19.26	Duty Runtime Reset	RW	Bit	-	0	
19.27	Starter 1 Runtime Reset	RW	Bit	-	0	
19.28	Starter 2 Runtime Reset	RW	Bit	-	0	
19.29	Starter 3 Runtime Reset	RW	Bit	-	0	
19.30	Starter 4 Runtime Reset	RW	Bit	-	0	
19.31	Starts Per Hour Protection Enable	RW	Bit		0	
19.32	Assist Fail to Start Flag	RO	Bit	-	-	
19.33	Duty No Flow	RW	Bit	-	0	
19.34	Starter 1 No Flow	RW	Bit	-	0	
19.35	Starter 2 No Flow	RW	Bit	-	0	
19.36	Starter 3 Flow	RW	Bit	-	0	
19.37	Starter 4 No Flow	RW	Bit	-	0	
19.38	No Flow Flag	RO	Bit	-	-	
19.39	Low Alarm Flag	RO	Bit	-	-	
19.40	Low-Low Alarm Flag	RO	Bit	-	-	

19.41	High Alarm Flag	RO	Bit	-	-	
19.42	High-High Alarm Flag	RO	Bit	-	-	
19.43	Starter 1 Available	RW	Bit	-	0	
19.44	Starter 1 Running	RW	Bit	-	0	
19.45	Starter 2 Available	RW	Bit	-	0	
19.46	Starter 2 Running	RW	Bit	-	0	
19.47	Starter 3 Available	RW	Bit	-	0	
19.48	Starter 3 Running	RW	Bit	-	0	
19.49	Starter 4 Available	RW	Bit	-	0	
19.50	Starter 4 Running	RW	Bit	-	0	

10.15.3 Menu 20

No.	Description	Type	Units	Range	Default	Setting
20.01	Reserved for Fieldbus option	-	-	-	-	
to		-	-	-	-	
20.19		-	-	-	-	
20.20	PID Output Scalar	RW	x0.1Hz		1	
20.21	Remote Speed Reference	RW	0.1Hz	01.07-01.06	0	
20.22	Cascade Stop Delay	RW	0.1sec	0-32000	20	
20.23	Cycle Time	RW	hours	0-32000	24	
20.24	PID Output Scaled	RO	0.1Hz* 20.20	0-32000	-	
20.25	Starter 1 Number of Starts Per Hour	RW	-	0-32000	5	
20.26	Starter 2 Number of Starts Per Hour	RW	-	0-32000	5	
20.27	Starter 3 Number of Starts Per Hour	RW	-	0-32000	5	
20.28	Starter 4 Number of Starts Per Hour	RW	-	0-32000	5	
20.29	Starter 1 Number of Starts Per Hour Counter	RO	-	0-32000	-	
20.30	Starter 2 Number of Starts Per Hour Counter	RO	-	0-32000	-	
20.31	Starter 3 Number of Starts Per Hour Counter	RO	-	0-32000	-	
20.32	Starter 4 Number of Starts Per Hour Counter	RO	-	0-32000	-	
20.33	Starter 1 Start per Hour Elapse Time	RO	Mins.	0-59	-	
20.34	Starter 2 Start per Hour Elapse Time	RO	Mins.	0-59	-	
20.35	Starter 3 Start per Hour Elapse Time	RO	Mins.	0-59	-	
20.36	Starter 4 Start per Hour Elapse Time	RO	Mins.	0-59	-	
20.37	Communications Watchdog Enable	RW	Bit	-	0	
20.38	Watchdog Clock time	RW	0.01sec	0-32000	50	
20.39	Watchdog Trip Delay	RW	0.1sec	0-32000	20	
20.40	Override Enable	RW	Bit	-	0	
20.41	Override Symmetrical Threshold	RW	EGU	18.14-18.12	10	
20.42	Process Preset Set point 2	RW	EGU	18.14-18.12	100	
20.49	Application Software Version	RO	-	0-32000	-	
20.50	Reserved for Fieldbus option	RO	-	0-32000	-	

NOTES:

1. **Units**

   EGU – EnGineering Units

   TIU – Terminal Interface Units (A/D output resolution)

   Sec – Seconds

Mins – Minutes

Hz – Hertz

2. *Ranges*

    18.14 – 18.12 denotes range is defined by specified parameter settings, in this example parameter 18.14 (min) to 18.12 (max).

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11 I/O Defaults

11.1 Terminal Mode 1

Parameter 19.25 =1

Term.	Type	Terminal Parameter	Description	Application Parameter
1	Relay	08.08	Starter 2 Run	18.46
2	Relay	08.08		
3	0V		Analogue 0v	
4	+10V		Analogue Supply	
5	ANI1+	07.01	Process Feedback	
6	ANI1-	07.01		
7	ANI2	07.02	Auto – Process set point Man – Speed set point	
8	ANI3	07.03	Motor Thermisters	
9	ANO1		Motor Frequency	02.01
10	ANO2		Process Feedback out	07.01
11	OV		Analogue 0v	
22	+24V		Digital Supply	
23	0V		Digital 0V	
24	DI1	08.01	Starter 1 Available	19.43
25	DI2	08.02	Starter 1 Running	19.44
26	DO3	08.03	Starter 1 Run	18.45
27	DI4	08.04	Starter 2 Available	19.45
28	DI5	08.05	Starter 2 Running	19.46
29	DI6	08.06	System Run	18.40
30	DI	08.07	Enable/Inhibit	
31	OV		Digital 0V	

11.2 Terminal Mode 2

Parameter 19.25 = 2

Term.	Type	Terminal Parameter	Description	Application Parameter
1	Relay	08.08	Starter 2 Run	18.46
2	Relay	08.08		
3	0V		Analogue Supply	
4	+10V		Analogue 0V	
5	ANI1+	07.01	Process Feedback	
6	ANI1-	07.01		
7	ANI2	07.02	Auto – Process set point Man – Speed set point	
8	ANI3	07.03	Motor Thermisters	
9	ANO1		Motor Frequency	02.01
10	ANO2		Process Feedback out	07.01
11	OV		Analogue Supply	
22	+24V		Digital 0v	
23	0V		Digital Supply	
24	DI	08.01	Starter 1 Available	19.43
25	DI	08.02	Starter 1 Running	19.44
26	DO	08.03	Starter 1 Run	18.45
27	DI	08.04	System Reset	18.50
28	DI	08.05	System Auto Select	18.41
29	DI	08.06	System Run	18.40
30	DI	08.07	Enable/Inhibit	
31	OV		Digital 0v	
40	Relay 2		Starter 3 Run	18.47
41	Relay 3	16.02	Starter 4 Run	18.48
42	Relay C	16.03		
43	0V		Digital 0V	
44	DI	16.10	Starter 3 Running	19.46
45	DI	16.11	Starter 4 Available	19.47
46	DI	16.12	Starter 4 Running	19.48
47	0V		Digital 0V	
48	DI	16.07	Starter 2 Available	19.49
49	DI	16.08	Starter 2 Running	19.50
50	DI	16.09	Starter 3 Available	19.45
51	ANI	16.04	Speed analogue Ref.1	01.36
52	ANI	16.05	Speed analogue Ref.2	01.37
53	0V		Analogue 0V	
54	ANO		Motor current	04.01
55	0V		Analogue 0V	

12 Documentation Reference

Manual Description	CT Part Number
Unidrive VTC User Guide	0461 - 0006
Unidrive User Guide	0460 - 0070
Unidrive Advanced User Guide	0447 - 1001
Additional I/O Small Option Module for Unidrive	0447-0046
Profibus-DP Interface	0460 - 0075
Interbus Interface	0460 - 0076
Modbus-Plus Interface	0400 - 0035
CTNet Interface	0460 - 0025
Devicenet Interface	0460 - 0077
CAN Interface	0460 - 0063
CANOpen Interface	0460 - 0061
UD70 RS485 Port (CTANSI, Modbus_RTU, custom)	0447 - 0017