



Product Manual

5901 Microtach

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5901 Microtach Product Manual

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CLASS 1 LASER PRODUCT

No precautions are necessary when viewing the fibre optic transmitter within the 5901 product.

The light from the fibre optic transmitter is of infra red wavelength, and not visible to the naked eye.

Chapter 1 Introduction

GENERAL DESCRIPTION

The SSD Drives Microtach is a combination of micro-electronics and laser technology packaged into a rugged industrial housing.

To provide high accuracy speed and position measurement an incremental encoder disk is used (1000 lines/rev) together with micro-electronics to facilitate the use of single fibre optic transmission of the encoder pulses. Fibre optic transmission of sensitive information in an electrically noisy environment is a simple and sensible step giving the supreme advantage of noise free signal transmission over considerable distances. Fibre optic technology has evolved to produce "user friendly" glass fibre cable with simple connectors suitable for factory floor use. The connectors use the international standard "ST" system, and ready made up, or custom terminated cables are available from many suppliers world-wide.

Two types of fibre optic cable are specified, and transmission distances of up to 1000m are possible, without the use of repeater units.

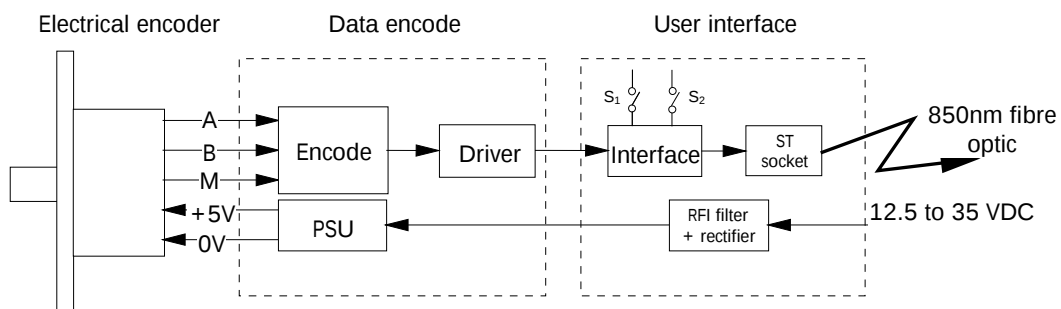
The housing is an industry standard flange mounting and includes shielded bearings as standard to discourage dirt and oil ingress whilst providing a high degree of mechanical integrity. The removable terminal end cover and cable gland are also sealed to a high standard when used with the appropriate conduit fittings.

The encoder is normally powered by the Microtach Universal Receiver, which is suitable for a number of drives and system products. Standard unscreened cable can be used, and the DC power supply terminals are independent of polarity. Alternatively, an external DC power supply can be used with a voltage of between 12.5 and 30V.

PRINCIPLE OF OPERATION

The Microtach uses a standard, proven electrical encoder which consists of an optically slotted glass disk with a number of tracks. The tracks are illuminated by an LED and the resultant light sensed by optical receivers.

The disk contains 3 tracks, A, B, and Marker. The A and B pulse trains are of the same frequency but displaced by 90 degrees. The frequency of the A and B pulse trains are proportional to the rotational speed of the shaft whilst the 90 degree phase displacement determines the direction of rotation of the shaft. The marker signal is a once per rev signal used in register positioning applications.



The above diagram shows the internal block diagram of the Microtach. The electrical encoder can be seen, providing the three pulse channels (A, B, M), described above.

The information contained in the three encoder wave forms is encoded into a serial data packet which is transmitted along the fibre optic at a 500KHz rate.

A switched mode power supply is used to power the internal electronics, and this results in a low power consumption over a wide operating voltage range. An RFI filter is used to allow immunity to external electrical interference on the power supply cables.

The receive decoding is the reverse process and will reproduce the three pulse trains with minimal distortion. The hardware for this process is contained within the Universal Receiver board or systems product.

Chapter 2 Fibre Optic Cables

TYPE OF CABLES USED

The Microtach uses up to date glass fibre systems which are both readily available and simple to terminate.

Installing the glass fibre cable

Unlike most electrical installations, one of the most important aspects of fibre optic systems, is the transmission distance down the fibre cable. The transmitted light is progressively attenuated down the fibre cable, and it is important that sufficient light is available at the receive end to allow fault free data transfer. Two cable systems have been characterised for use with the Microtach, and typical maximum transmission distances specified. These maximum distances assume that the cable is not damaged, or strained through excessive tensile force during the installation process.

The fibre optic cable should be carefully installed to prevent damage, and subsequent light loss. This is important, since Microtach systems may appear to work well, but fail after some time, due to cable damage.



Great care should be taken when installing fibre optic cable in cable trays and trunking systems. The recommended fibre optic cable is quite strong, but care should be taken to prevent damage due to snagging of the outer sheath layer on sharp corners etc. This is especially so, if ready made up lengths of cable are installed. Here, the connectors present an additional snagging hazard.

The maximum transmission distance is more than adequate for the Microtach used in most motor speed and position feedback applications.

With all fibre optic cables, the routing of the cables is important. Cables must not be routed with bend radii less than the recommended levels given in the tables. If cables are sharply bent, the maximum drive length may not be achievable. Worse still, there may be a progressive deterioration in the transmission properties of the cable, which could result in eventual failure.

Cables are available in a number of styles, from light to heavy duty for all industrial applications. As with any electrical cable, care should be taken when installing fibre cables, to avoid physical damage which could impair the transmission properties.

Cables can be terminated with the ST connectors, either by a local fibre optic supplier, or by using the tool kits described in the following sections. Cables may purchase ready terminated in standard lengths, and any excess coiled up inside the appropriate control panel. Local fibre optic contractors may also be used to terminate cables to the correct length on site.

Recommended cable systems

Two types of fibre cable are specified (that are switch selectable - S2) for use with the Microtach, and the following sections provide the necessary detail. Other cables can be used, but no guarantees can be given as to transmission distance.

The manufacturers part numbers quoted are believed to be correct at the time of printing of this manual. Further information about the fibre optic systems can be obtained from the manufacturers given below.

62.5/125u glass system (Selection switch S2 ON)

This is standard fibre optic communications cable, and is widely available.

Minimum transmission distance - 0m.

Maximum transmission distance - 150m.

System Manufacturer	Amp
Cable	Single light duty, part No. 502083-1 (a)
Min cable bend radius	45mm
ST Connector	Lightcrimp XTC No-Epoxy Part No. 504001-1
Termination kit	Part No. 503125-1

Note (a) - The glass fibre cable is available in different styles to suit the site environment. Multiple cables are also available.

200u glass system (Selection switch S2 OFF)

Due to the large cable diameter, this fibre cable is relatively simple to terminate, using the approved tool kit. The large diameter also allows a increased light coupling power to the cable, and an associated increase in maximum transmission distance.

Traditionally with glass fibre systems, the cables had to be terminated with the connectors, using a time consuming epoxy and polish method. This required skilled personnel to terminate cables. This 200u system allows connector termination without the need for epoxy and polishing techniques.

Minimum transmission distance - 0m.

Maximum transmission distance - 1000m.

System Manufacturer	Ensign Bickford
Cable	Single light duty part No. HCP-M0200T-006 (a)
Min cable bend radius	24mm
ST Connector	HCS crimp and cleave to suit cable Part No. CC-ST-230
Termination tool kit	Part No. TK6

Note (a) - The glass fibre cable is available in different styles to suit the site environment. Multiple cables are also available.

Fibre optic system losses

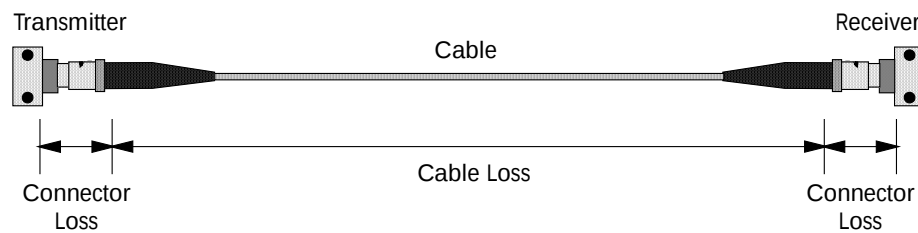
There are two types of cable specified for use with the Microtach, and this is described above. This section provides basic information for the user to specify other types of cable and connectors.

Unlike an electrical transmission system, the maximum transmission range of a fibre optic system is dependant on the various losses in the connectors and cable. These losses can be broken down into two main areas:-

1) Cable losses

2) Connector losses

These losses are shown in the following diagram



It can be seen that any simple fibre optic system has three main losses:-

- 1) Transmitter connector loss
- 2) Cable loss
- 3) Receiver connector loss

In general, the transmitter and receiver connector losses are the same. The cable loss is dependant on the type and length of cable being used. In order for the fibre optic system to work properly, the following equation must be obeyed:-

$$(\text{Min Transmit power in dBm}) - (\text{Losses in dB}) > (\text{Minimum receiver sensitivity in dBm})$$

Losses are generally specified in dB. Light power is generally specified in dBm, referred to 1mW of power. These units allow the above equation to be easily performed.

The minimum transmit power and receiver sensitivity are fixed within the design of the Microtach. This allows the maximum cable loss to be calculated, to obey the above equation.

The following table shows the maximum allowable losses for three sizes of cable. Note that the size of the cable determines the amount of light that can be coupled to the cable. The transmit and receive powers are fixed within the design of the Microtach.

Cable diameter	62.5/125 μ cable	100/140 μ cable	200 μ cable
Min transmit power into cable (a)	-18.47 dBm	-14.4 dBm	-8 dBm
Min receive power	-25 dBm	-25 dBm	-25 dBm
Gives max allowable total loss ^(b) of	6.53 dB	10.6 dB	17 dB

Note (a) - Scaled from manufacturers data for 100/140 μ cable. Here the minimum power into the cable is -14.4 dBm

Note (b) - For both connector and cable losses.

It is not recommended to use smaller cable than 62.5/125 μ . Here, the transmit power into the cable becomes unacceptably small.

The following table subtracts the connector loss for the two specified fibre optic systems. These losses are derived from manufacturers data. If other cable systems are used, this data should be used here.

Cable system	Amp 62.5/125 μ	200 μ HCS
Max allowable loss from above	6.53 dB	17 dB
Minus Loss safety factor(a)	5 dB	4.5 dB
Minus Transmit connector loss	0.5 dB	3 dB
Minus Receive connector loss	0.5 dB	3 dB
Gives max allowable cable loss of	0.53 dB	6.5 dB

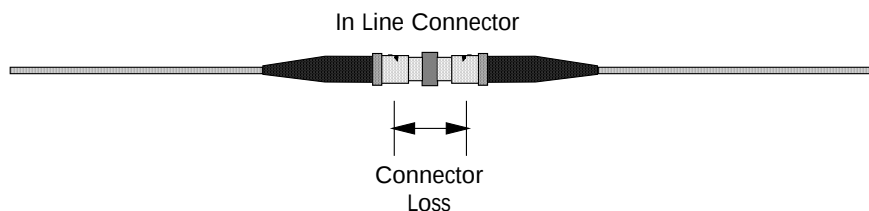
Note (a) - To allow for any unknown factors such as excessive bends in the cable and poor quality connector joints.

The following table shows the loss of the two types of specified cable at the Microtach transmitted wavelength of 850nm.

Cable system	Amp 62.5/125 μ	200 μ HCS
Cable Loss per 100 metres	0.35 dB	0.6 dB
Max cable length using above loss	150m	1083m

In line connectors

In line connectors are available for the ST system. These allow connection of fibre cables as shown in the diagram below



If these connectors are to be used, the extra loss introduced, must be subtracted from the total cable loss figures described in the above table.

Chapter 3 Installation and Commissioning

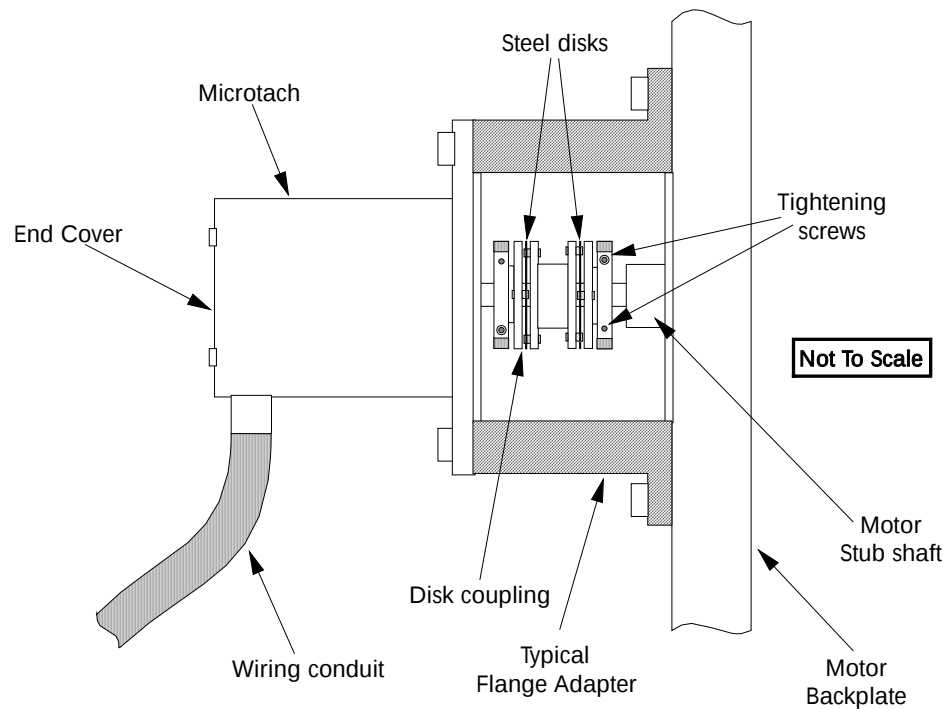
MOUNTING THE MICROTACH

The Microtach is designed for use as a speed and position sensor for industrial motors. It is available in two industry standard flange types to suit common motor adapters in Europe and the USA:-

5901/1 - European RE0444 Flange

5901/4 - American 4 hole flange

The following sketch shows a typical Microtach mounting arrangement.



A suitable flange adapter should be used to mount the Microtach onto the back of the motor. The flange adapter is used to convert between the motor back plate and the Microtach flange as described above.



Caution

The Microtach contains a standard electrical pulse encoder, which uses a glass disk. It is most important that the Microtach is handled with care during installation. Excessive shock will damage the glass disk, and this will invalidate the warranty.

A stub shaft should be provided to allow the Microtach to be connected to the motor shaft. This is shown in the above diagram.

It is most important with any tachometer transducer, that a good quality coupling is used to connect to the motor shaft. For the Microtach, the recommended coupling is a spring disk type. This has a high torsional stiffness and allows some misalignment of the two shafts. The part number of this coupling is BM059104 (only suitable for 5901/1).

To mount the coupling onto the shaft, ensure that the tightening screws are loosened, and slide the coupling over the appropriate shaft. Tightening the screws will cause the coupling to grip the shaft. There is no key way provided on the Microtach shaft, and this is not necessary.

Ensure that the steel disks of the coupling are not strained in any way, or the life will be severely limited. The steel disks are shown in the above diagram.



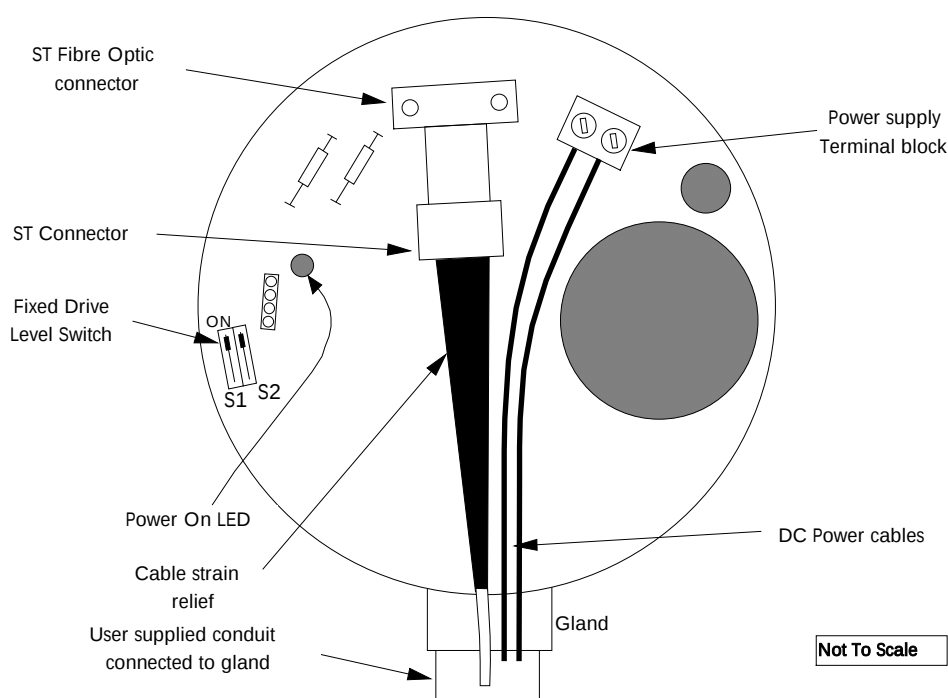
Caution

The shaft of the Microtach is precision machined to close tolerances. The shaft should not be machined or otherwise altered. This may produce excessive shock within the Microtach which could damage the glass disk. Any alteration of the shaft will invalidate the warranty.

CONNECTION

Fibre Optic Cable

The connections to the 5901 consist of a single fibre optic plug and two standard wire terminals for the power supply. The end cover of the Microtach should be removed by loosening the two retaining screws.



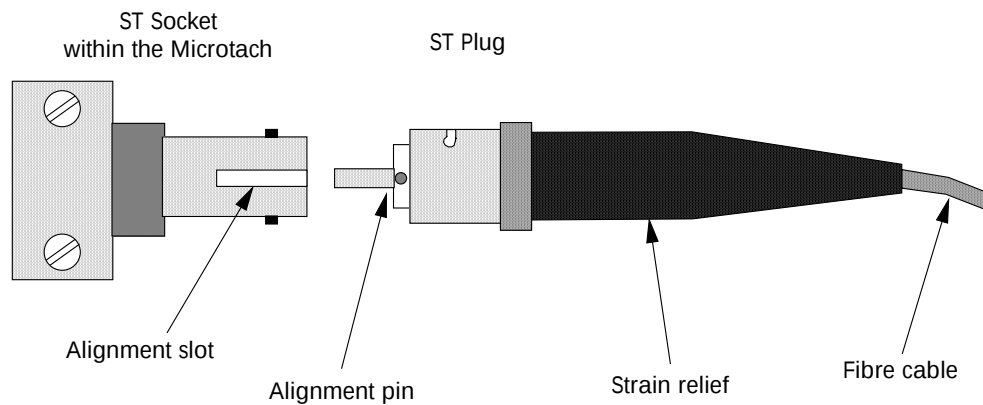
The above sketch shows the location of the fibre optic connector and power terminals.

Once the end plate has been removed the gland insert should be unscrewed from the body section. The fibre optic cable and power supply cables should be prepared, then be inserted through the gland and rubber grommet.

The termination procedure for the fibre optic plug is dependant on the type of fibre optic cable, and this is discussed in the above section.

To insert the ST plug into the connector, first align the pin on the plug with the slot in the socket. The plug can then be pushed fully into the socket and twisted to engage the bayonet connector.

Ensure that the cable is not twisted in any way inside the Microtach. The exit of the fibre optic from the body should be as smooth as possible.



The above sketch shows the fibre optic plug and socket. The plug has an alignment pin which must be aligned with the associated slot in the socket ensure that selector switch S2 is in the correct position

After connecting the fibre optic plug the power supply cables may be connected using the screw terminals provided. It should be noted that the polarity of the terminals is unimportant.



Caution

The supply voltage of the Microtach is 12.5 to 30V DC. Any applied voltages outside this range may damage the unit and will invalidate the warranty. It is wise to carefully check the power supply wiring before powering up the Microtach.

A suitable protection device should be used in the power supply cables of the 5901. All connection wiring should be of sufficient rating to prevent long term overload within the full range of the protective device. Examples of such protection devices are fuses, circuit breakers and current limited power supplies.

Cabling should be segregated from adjacent high voltage circuits, unless double insulated cabling, rated at the highest system voltage is used.

A protective earth is not required for the 5901 Microtach since the supply voltage is not hazardous live.

NOTE - THE 5901 DC POWER SUPPLY MUST BE FULLY ISOLATED FROM THE AC MAINS SUPPLY. IDEALLY THE 0V OF THIS POWER SUPPLY SHOULD BE CONNECTED TO THE EARTH.

The gland should now be tightened ensuring the cable is not twisted. The end plate is then replaced and secured. Note that the fibre optic plug may be withdrawn through the body gland to allow replacement and strip down of the completed installation.

The fibre and electrical cables should be contained within a conduit system which is connected to the gland of the Microtach.

**Caution**

In order for the IP rating to be satisfied, the cable conduit must seal correctly to the gland on the Microtach.

COMMISSIONING

Since there are no user adjustable parts within the unit, commissioning is very straightforward.

The +24V DC power should be applied and a check made that the power on LED is illuminated. This is located adjacent to the fibre optic connector under the end cover of the product.

Verification of operation should be performed by observing the speed or position feedback signals from the Microtach receiver. Here, the appropriate product manual should be consulted. The two receiver LED's:-

Fixed light

No light

should be illuminated, and this gives some indication as to correct operation. The universal receiver card is described later in this manual.

The drive level switch S1 and resistor which can be seen under the end cover, are to allow measurement and adjustment of the fibre optic launch power. The drive level has been carefully specified to allow the fibre drive lengths indicated above. Further adjustment of these components should not be necessary, and should only be performed by SSD Drives personnel, normal position for S1 is OFF.

S1	S2	
OFF	OFF	Normal operation 200 ○ glass
OFF	ON	Normal operation 62.5/125 ○ glass
ON	OFF	Constant Light output
ON	ON	Constant Light output

NOTE: CONSTANT LIGHT OUTPUT ALLOWS CABLE ATTENUATION MEASUREMENTS. THIS IS NOT FOR NORMAL OPERATION.

Further commissioning should be carried out according to the appropriate drive product manual.

**Caution**

The 5901 is designed to be used as a speed feedback sensor. Great care should be taken during the installation process. Rotating machinery which is not controlled, due to speed feedback errors is potentially dangerous.

Chapter 4 Specification and Product Codes

MECHANICAL SPECIFICATION

Dimensions	See mechanical drawings
Radial shaft loading	110N
Axial shaft loading	130N
Starting torque	0.007Nm
Bearing life	10 ⁹ revolutions
Maximum operating speed	3000 RPM
Maximum mechanical speed	6000 RPM
End bearing type	Shielded
Weight	Note (a)

Note (a) - May vary dependant on the case style.

ENVIRONMENTAL SPECIFICATION

Operating temperature	0 to 70°C
Storage temperature	-25 to 80°C
Ventilation Requirements	Not required
Relative humidity	Up to 98% non-condensing
Protection	IP54 with sealed conduit connected to cable gland (a)
Nominal shock	20G for 11ms duration (a)
Nominal vibration	10G, 5 to 2000Hz

Note (a) - IP20 with an unsealed conduit connected to cable gland.

ELECTRICAL / OPTICAL SPECIFICATION

Power supply voltage	12.5 to 30 VDC
Maximum power requirement	3W
Maximum power cable size	1.5mm ⁽²⁾
Fibre optic connector standard	ST
Fibre optic transmitter	Honeywell HFE4020-013-BBA
Fibre Optic Wavelength	850nm Infra Red
Fibre optic cable	Ensign Bickford 200u HCS glass AMP 62.5u/125u
Transmission distance	0 to 150m for 62.5u/125u cable 0 to 1000m for 200u cable

MATERIALS USED

Housing	Aluminium alloy
Interior body	Aluminium alloy
Shaft	Anti-magnetic stainless steel

PRODUCT CODES**5901/1 European Flange**

5901/1 Part Number DD387191U001	European 6 hole flange (REO444R). 20mm conduit gland. 1000 Pulse Per Rev.
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5901/4 American Flange

5901/4 Part Number DD387191U004	US 4 hole flange. 1/2 Inch NPT conduit thread 1000 Pulse Per Rev.
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Chapter 5 Fibre Optic Cable

SOURCES OF FIBRE OPTIC CABLE

Since the 5901 Microtach uses a standard cable and connector system, this can be sourced, and terminated locally.

Chapter 6 Mechanical Drawings

The mechanical drawings for the Microtach are provided to give accurate details of the flange styles. The body styles and detail may vary.

The mechanical drawings may be found in the back of this manual.

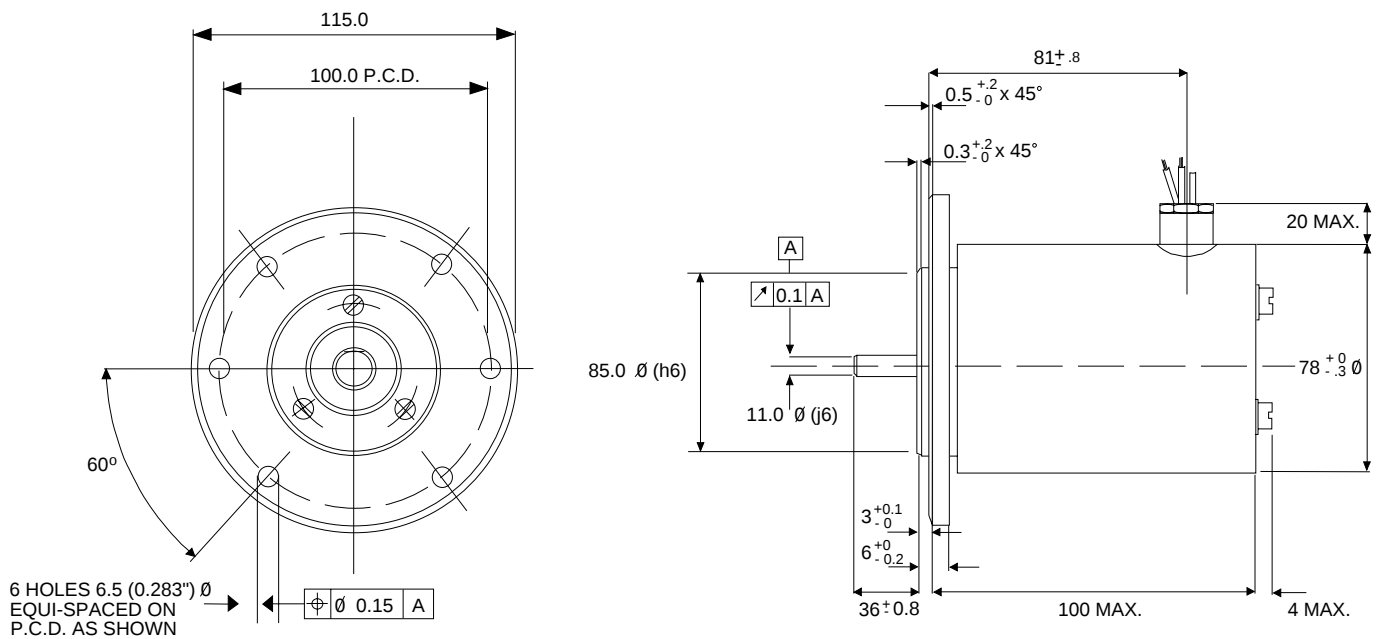
5901/1 EUROPEAN FLANGE

Top diagram overleaf.

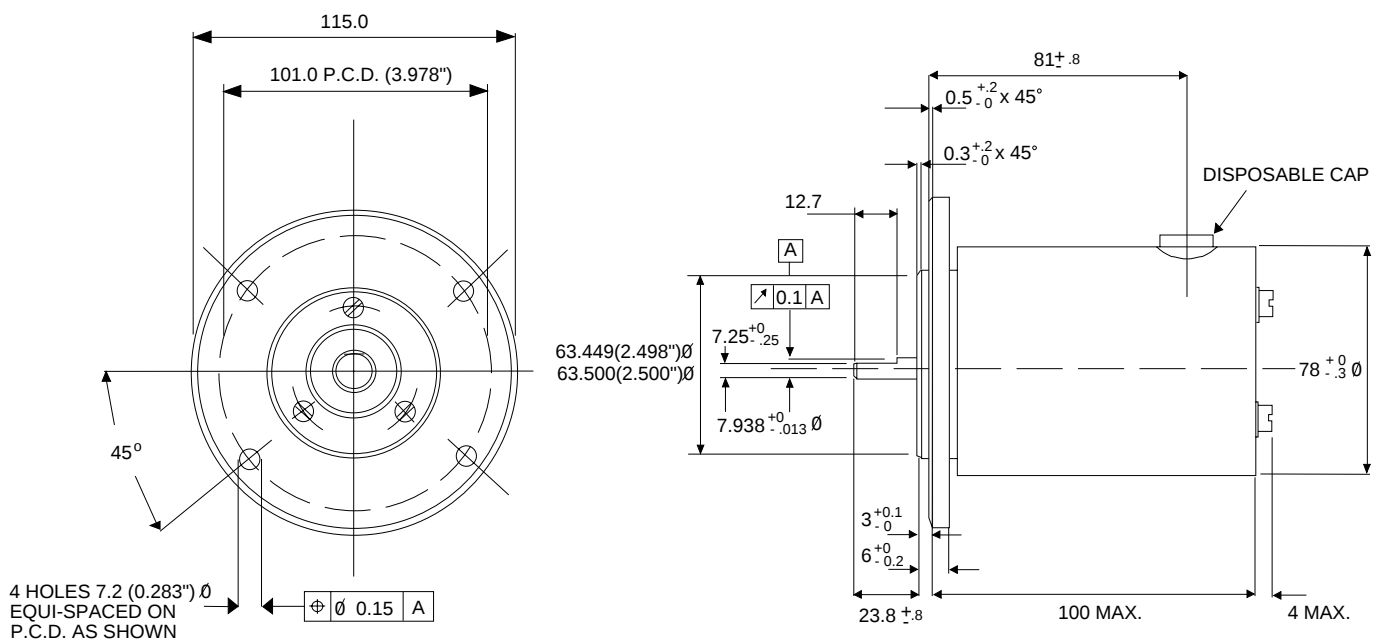
5901/4 AMERICAN FLANGE

Bottom diagram overleaf.

MECHANICAL DRAWINGS FOR 5901/1 AND 5901/4



MICRO-TACH 5901/1 (EUROPEAN)



MICRO-TACH (AMERICAN) 5901/4

Chapter 7 Maintenance

GENERAL MAINTENANCE

The 5901 Microtach does not contain any user serviceable parts.

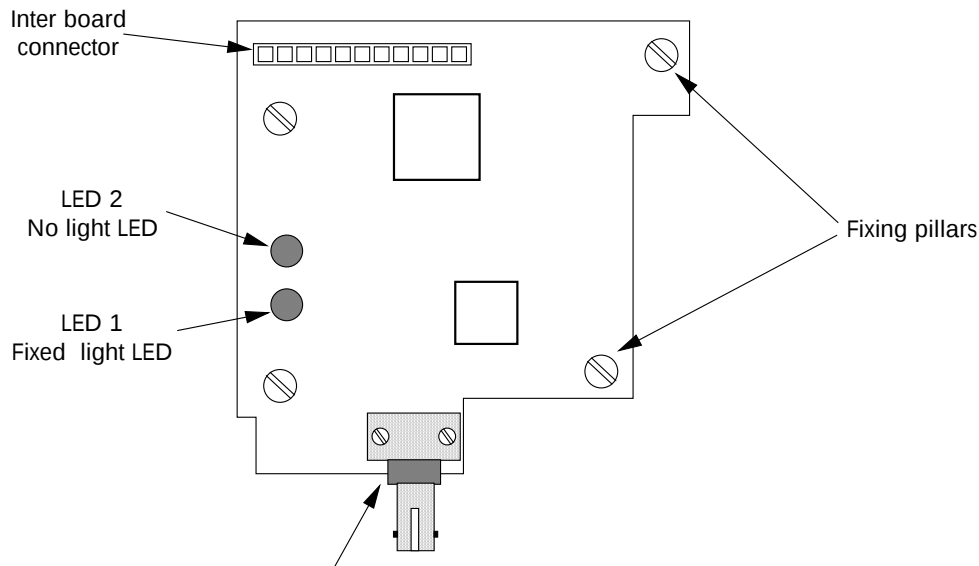
Chapter 8 5901 Universal Receiver Card

DESCRIPTION

This card is designed to convert the glass fibre optic data into electrical data, suitable for pulse feedback applications on SSD Drive products.

The card is suitable for mounting on a number of drive products, to provide accurate speed feedback.

The following diagram shows the layout of the universal receiver card.



The ST connector receives the fibre optic light from the 5901 at the other end of the cable. Mechanically, this connector is identical to that seen in the 5901.

Two LED's are provided which should normally be illuminated. LED 2 detects no light being received, and LED 1 detects a fixed light level. The fixed light level switch (S1-ON) in the 5901 allows fixed light to be sent down the cable for measurement purposes. If fixed light is being sent, speed feedback is not possible and LED 1 will not be illuminated.

The card fixes to the drive control PCB using snap in pillars. The electrical interface is via an 11 way connector.

The card will usually be supplied and fitted to the appropriate drive product. If the card is supplied loose for any reason, great care must be taken in fitting to ensure that the connector pins are not bent, and the card is snapped fully home on the pillars.

COMMISSIONING

Commissioning the receiver card is very straightforward, and has been outlined above.

Chapter 9 Troubleshooting

The following tables provide some guidance, if problems should occur with the 5901 and associated receiver card.

RECEIVER LED'S

LED code	Possible solution
LED 1 ON, LED 2 ON	Normal operation
LED 1 OFF, LED 2 ON	Check fixed light switch in the 5901. This link should not be made 5901 faulty Receiver card faulty
LED 1 ON, LED 2 OFF	No power on 5901 check LED inside enclosure Fibre optic cable not connected Fault in fibre optic cable. Check for excessive bends and damage to the cable and connectors. The loss levels must meet the specification described in the above sections 5901 faulty Receiver card faulty
LED 1 OFF, LED 2 OFF	No power on the drive control board Receiver card faulty

SPEED FEEDBACK

LED's normal but poor speed holding observed	Check for damage to the fibre optic cable or connectors. The loss level in the cable must meet the specification described in the above sections 5901 faulty Receiver card faulty
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ISS.	MODIFICATION	C.P. No.	DATE	APPROVAL
1	Initial Issue. HA387484C	9042	17.03.94	
2	Page 1-1 added S2 to diagram. Pages 2-1 & 2 added (that are switch selectable - S2). Page 3-1 replaced "given at the back of this manual" with "BM059104 (only ... /1)". Page 3-2 changes to diagram. Page 3-3 Added "ensure that selector switch S2 is in the correct position", and "A suitable protection ... EARTH." Page 3-4 added:- "S1", "normal position for S1 is OFF" and table for S1, S2 and following Note. Page 4-2 added part numbers. Page 6-2 corrected title and page reference. Page 7-1 Added section on "Maintenance". Page 8-1 added "(S1-ON)". Back page removed telex number and added "1" to telephone code.	10821	26.03.96	
3	Replaced Eurotherm with SSD.	10748 18354	11 Nov 04	RBR
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