

# SmartScan Product Manual

Document Ref:	3100-3002 Iss E
Document Date:	30th Aril 2013
Prepared by:	KMJ
Approved by:	RT

*This information herein is the property of Smart Fibres Ltd and is to be held strictly in confidence by the recipient. No copy is to be made without the written permission of Smart Fibres Ltd. Disclosures of any of the information herein is to be made only to such persons who need such information during the course of their engagement or employment at Smart Fibres Ltd or under the written authority of Smart Fibres Ltd.*

*Any patent applications, patents and/or design applications, registered designs or copyrights arising from or contained in the information herein, shall be considered the property of Smart Fibres Ltd and as such are subject to the aforementioned obligation of confidence on the recipient.*

1	Introduction .....	3
1.1	Product Description .....	3
1.2	Packing List .....	4
2	Safety Information.....	4
2.1	Safety Symbols.....	4
2.2	Laser Safety .....	4
2.3	CE Compliance.....	4
3	Specifications .....	5
4	Installation .....	6
4.1	Mounting Details.....	6
4.2	Optical Connections .....	6
4.3	Electrical Connections .....	6
4.4	Interrogator Status LED.....	7
5	Maintenance .....	8
5.1	Optical Connector Cleaning.....	8
5.1.1	Inspection .....	8
5.1.2	Dry cleaning .....	9
5.1.3	Wet cleaning.....	9
5.1.4	Cleaning Flowchart.....	10
5.1.5	Cleaning tools.....	11
5.2	Interrogator .....	11

## Document Revision History:

Issue	Issue Date	Change
E (this document)	30 <sup>th</sup> April 2013	SmartSoft sections removed and now contained in separate manual, (See 3100-3008)
D	31 <sup>st</sup> March 2011	Plug-ins for Field Upgrades & NTP sync option. Added FBG spec to specifications
C	18 <sup>th</sup> October 2010	Include instructions for the time of flight correction : 5.4.3 and 6.5 modified
B	1 <sup>st</sup> September 2010	Updated SmartScan Lite wavelength range and scan frequency on specifications page
A	10th May 2010	Modified in line with SmartSoft V2.00
Draft	18 <sup>th</sup> September 2009	New document

# 1 INTRODUCTION

## 1.1 PRODUCT DESCRIPTION

SmartScan is an ultra compact and robust interrogator for dynamic measurement of Fibre Bragg Grating (FBG) sensors. This Wavelength Division Multiplexing (WDM) instrument is based on an agile, tuneable laser source that enables high-resolution interrogation at multi-kHz frequencies.

SmartScan is available with 1, 2 or 4 optical channels; multiple sensors can be multiplexed on each fibre without reducing acquisition speed or performance.

SmartScan connects to a host PC using standard Ethernet. Optionally SmartScan can integrate directly with a PLC or other supervisory system.

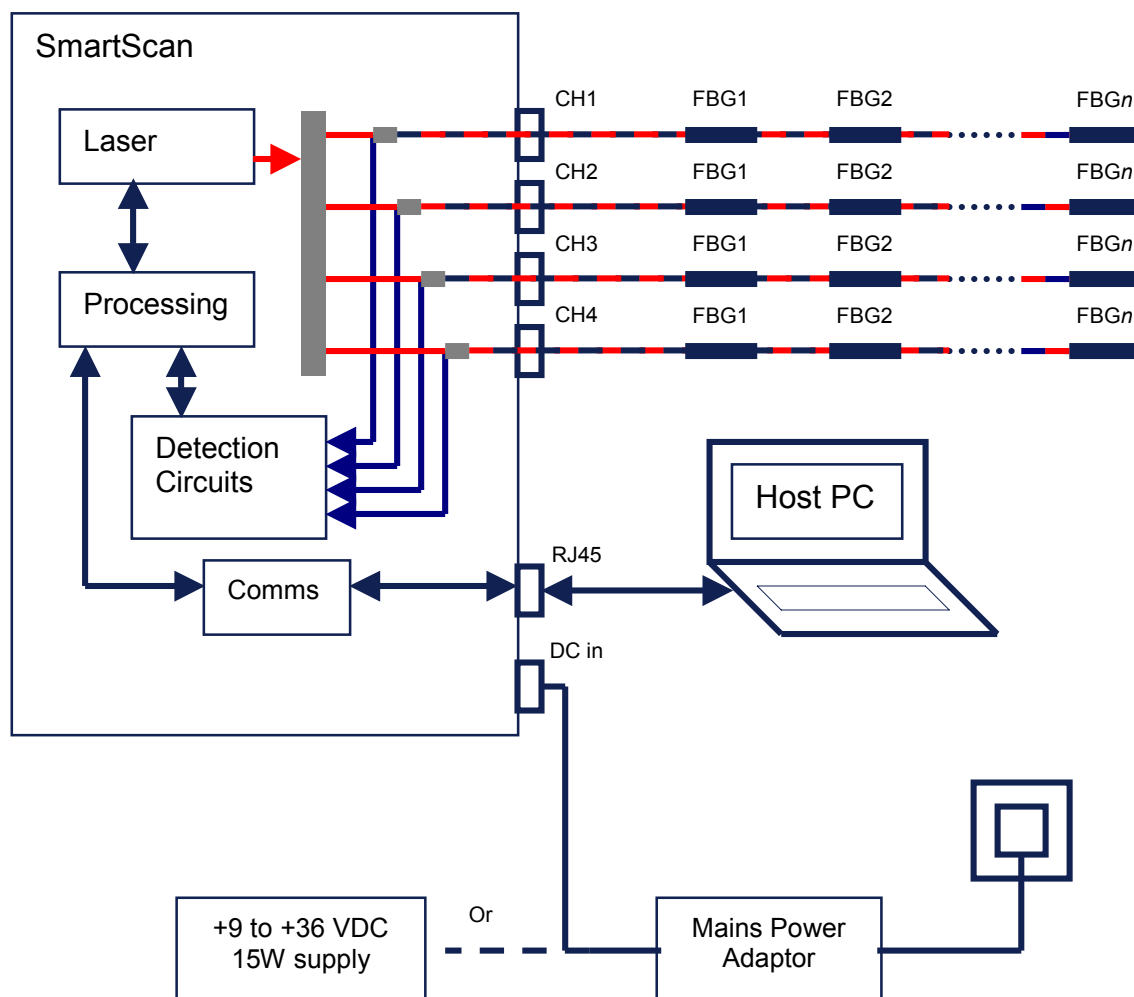


Fig. 1 SmartScan System Diagram

## 1.2 PACKING LIST



The SmartScan package should contain the following items as standard. If any items are missing please contact Smart Fibres or your local representative immediately.

- SmartScan Interrogator
- Rugged carry case
- SmartSoft Installation CD
- Ethernet Cross-over cable
- Mains power adaptor and regional mains cable or DC power cable

## 2 SAFETY INFORMATION

### 2.1 SAFETY SYMBOLS

The following symbols may be present on the unit.

Symbol	Description
	Laser Safety. Refer to user manual for safety instructions for use.
	Refer to user manual for safety instructions for use and handling.

### 2.2 LASER SAFETY

Applicable Standard: EN60825-1 (Safety of Laser Products)  
 Laser Type: cw  
 Laser Class: 1M  
 Max power: 2.5 mW  
 Wavelength: 1528-1568nm

Refer servicing only to qualified and authorised personnel.

**WARNING:** Use of controls or adjustment of performance or procedures other than those specified for the laser source may result in hazardous radiation exposure.

### 2.3 CE COMPLIANCE

Applicable Standards:  
 EMC Directive (EMC 89/336/EC)  
 EN61325-1 (*Electrical equipment for measurement, control and laboratory use. EMC requirements*)

### 3 SPECIFICATIONS

<b>Measurement and Processing</b>	
Wavelength Range	40 nm (1528 – 1568 nm), <i>SmartScan Lite: 35 nm (1529 - 1564 nm)</i>
Number of Optical Channels	1, 2, 3 or 4
Bragg Grating Full Width Half Maximum (FWHM)	Minimum >0.2 nm, > 0.5 nm recommended
Maximum Number of Sensors / Channel <sup>1</sup>	16
Scan Frequency (all sensors simultaneously) <sup>2</sup>	2.5 kHz, <i>SmartScan Lite: 250Hz</i>
Repeatability <sup>3,4</sup>	< 1 pm
Wavelength Stability <sup>4</sup>	< ±5 pm over operating temperature range, +/- 20 pm over 25 years
Dynamic Range	27 dB
Gain Control	9 levels, per channel or per sensor, automatic or user controlled
On-board Processing <sup>5</sup>	For conversion of measuring units and interfacing to client systems
On-board Data Storage <sup>5</sup>	Optional via USB memory stick
<b>Mechanical, Environmental and Electrical</b>	
Dimensions	140x110x70 mm / 5.5x4.3x2.8"
Weight	0.9 kg / 2 lb
Operating Temperature	Std: -10 to +50 °C / 14 to 122 °F   Ext: -20 to +60 °C / -4 to 140 °F
Comms Interface	Ethernet (UDP-IP), others on request
Data Connector	RJ45 standard
Optical Connectors	FC/APC 2.5 mm Ferrule diameter, alternatives on request
Input Voltage	+9 to +36 VDC or 100 to 240 VAC via supplied mains adaptor
Power Consumption	typ 7.5W, max 10W

<sup>1</sup> Subject to spectral bandwidth restrictions

<sup>2</sup> Higher frequencies achievable over narrower bandwidth, e.g. 20 nm at 5 kHz, 10nm at 10 kHz

<sup>3</sup> Measured over 1 minute, no averaging, standard uncertainty (1  $\sigma$  distribution)

<sup>4</sup> Using FBG with recommended FWHM as stated

<sup>5</sup> Optional extra

## 4 INSTALLATION

### 4.1 MOUNTING DETAILS

Currently SmartScan is for bench top use; other mounting arrangements including DIN rail available on request.

### 4.2 OPTICAL CONNECTIONS

SmartScan may have 1, 2, 3 or 4 FC/ACP connectors for connecting Single Mode Fibres. These are numbered from the left as CH1, CH2, CH3 and CH4. Observe the recommended connector cleaning practice described in Section 6. Connectors should only be fastened finger tight, take care to correctly align the key-way when mating the connectors.



### 4.3 ELECTRICAL CONNECTIONS

A = On/Off Switch

B = DC power Input

C = Power and Status light

D = RJ45 Ethernet Connector with built-in network status lights

E = Serial connector for diagnostics/servicing

There is also a USB port, which is currently inactive but may be used in future developments

#### 4.4 INTERROGATOR STATUS LED

OFF	Interrogator not powered or boot-up not complete
RED	System Error
GREEN	Interrogator booted an operational

Note, during power up the sequence is as follows:

1. LED Off
2. Power applied to Interrogator, LED remains off for approximately 10 seconds
3. LED Red briefly, Interrogator not ready
4. LED Green, Interrogator ready

## 5 MAINTENANCE

### 5.1 OPTICAL CONNECTOR CLEANING

The use of optical fibre connectors requires some care if good results are to be obtained. The core of the fibre is very small, typically 8 to 9 micrometres in diameter and even the smallest dust particles, lint fibres or smears of oil can obscure it and cause optical losses. Scratches and chips in the highly-polished end face of the fibre also result in poor quality, unreliable connections. Therefore, it is important to develop good habits for handling and cleaning connectors. Ideally, both sides of a connection should be inspected and cleaned before mating.

Connector tips can easily be damaged by hitting a hard surface. This can be avoided by always keeping the plastic cover in place when not using or cleaning the connector.

A brief guide to good practise is given here. The interested reader will find further information from Industry bodies. There are also some useful proprietary standards in the public domain, for example:

- AT&T: document ID ATT-TP-76461
- Cisco: document ID 51834
- JDSU: document ID IBYC – Fiber Inspection, Cleaning & Test

Note: These documents are identified for information only. No connection between any of the named companies and Smart Fibres Ltd is intended or should be implied.

We understand that the first time user of a Smart Fibres product may not have all the correct equipment to hand but cleaning and inspection tools are relatively inexpensive and help to ensure continued correct operation of the interrogator. The regular user should make an effort to acquire them and learn how to use them effectively

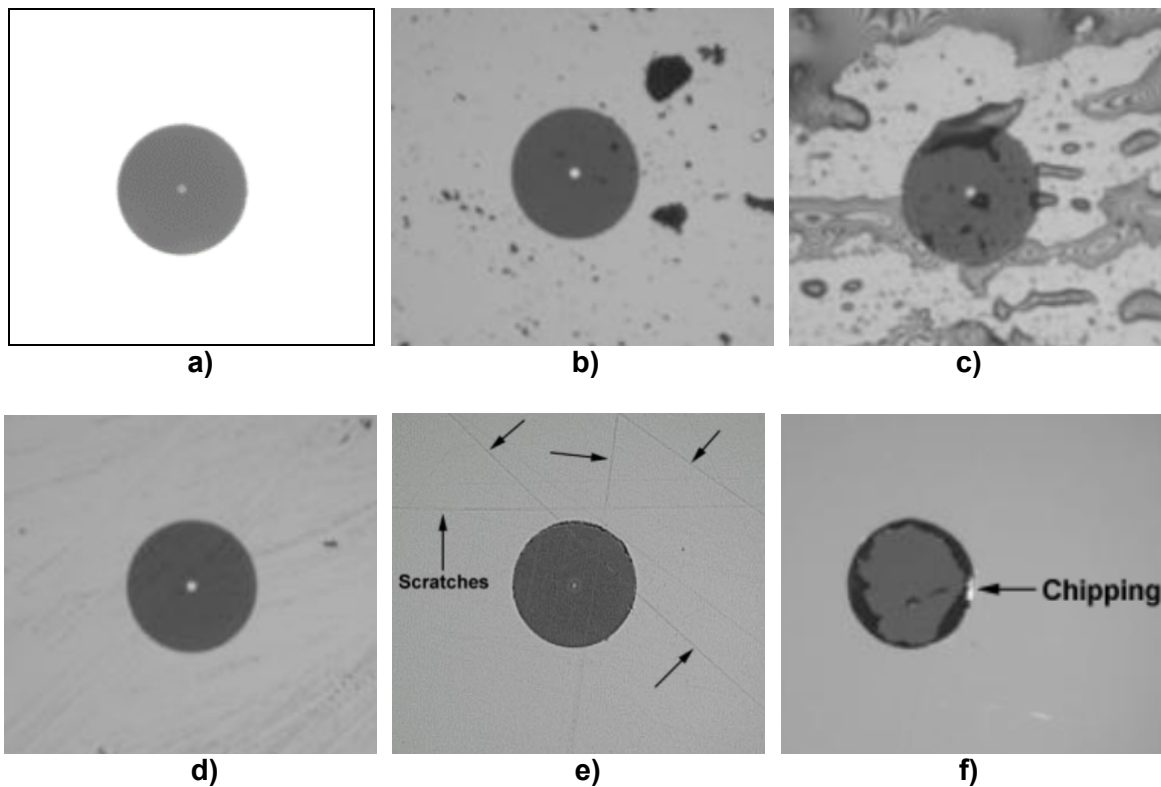
Some or all of the operations described below may be required to ensure that the fibre-optic connection is free from contaminants. The order of operations is given in Section 5.1.4, 'Cleaning Flowchart'.

#### 5.1.1 Inspection

It is highly desirable to inspect the end-face of connector ferrules (the white ceramic part) before mating them, to ensure that they are clean and undamaged. If no inspection means is available, you may skip this stage and proceed to a dry cleaning step, but be aware of the risk of making lossy connections by mating ferrules that may be contaminated or scratched.

Remove the protective cap from the connector ferrule. Insert the connector into the fibre inspection microscope and examine the end face. If the connector is of an angle-polished type, it may be necessary to rotate it in order to see the end of the fibre clearly. Bulkhead connectors, such as those in the front face of a Smart Fibres interrogator, can only be inspected using a fibre video microscope with a suitable adapter. Typical views of a ferrule end-face are shown below:





- a) Clean fibre end-face, ready for mating.
- b) Dust particles on connector. Cleaning needed.
- c) Liquid on connector. Cleaning needed.
- d) Oily streaks on connector. Cleaning needed.
- e) Connector is clean but has scratches. This is acceptable as there are no scratches on the fibre core. Ready for mating.
- f) Fibre cladding is chipped. A small amount of chipping is acceptable but this connector should be replaced.

### 5.1.2 Dry cleaning

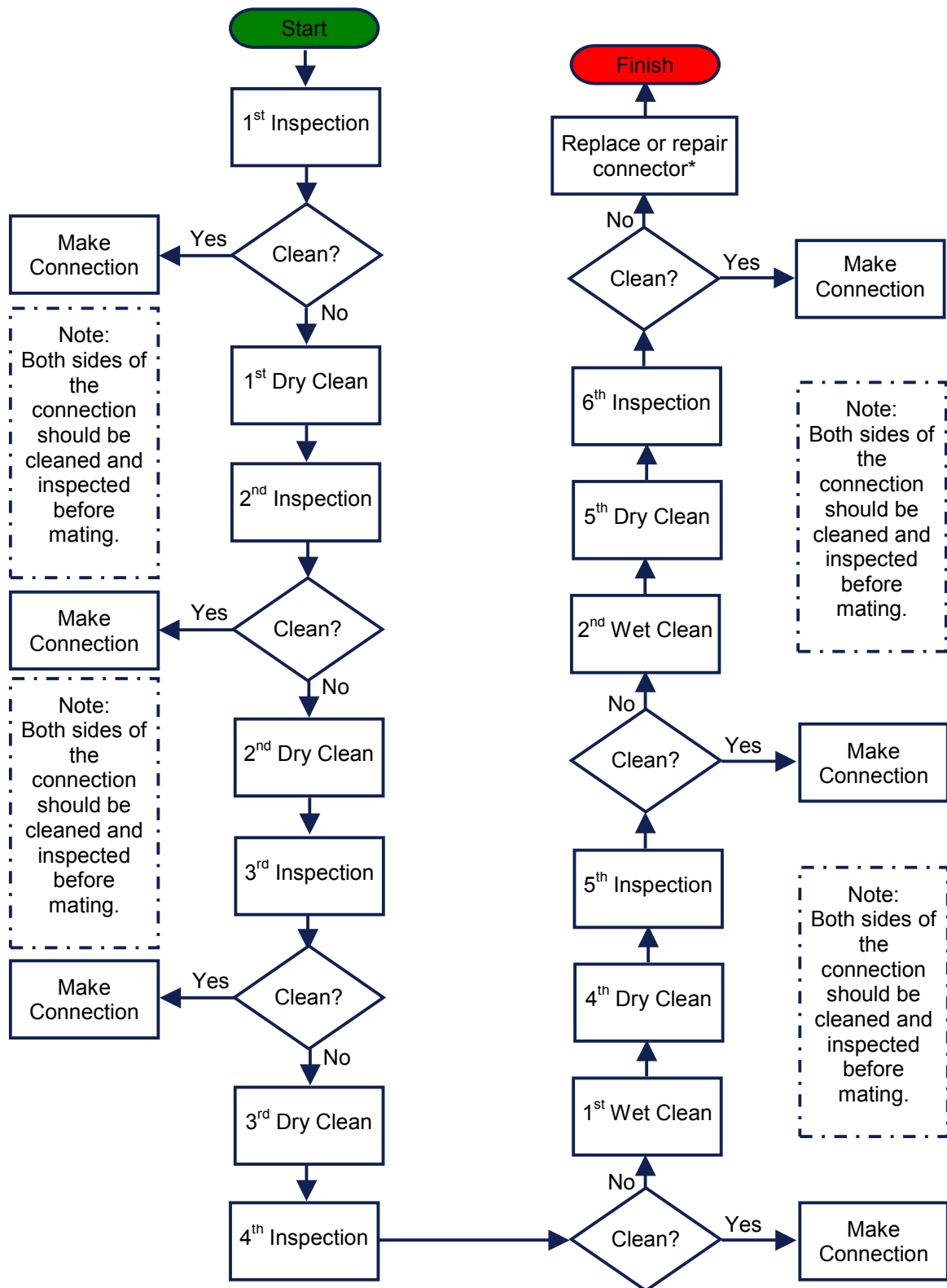
Dry cleaning involves wiping contaminants from the connector end-face using a clean, lint-free cloth. It is important to use fresh cleaning material for each wipe. Gentle but firm pressure is required, enough to depress slightly the spring-loaded ferrule. We recommend you use a 'Cletop-s' type cleaner for free connectors and a 'One-click' type cleaner for bulkhead or other recessed connectors.

### 5.1.3 Wet cleaning

If a contaminant resists removal by dry cleaning methods then wet cleaning may be needed. The process is similar but the cleaning material is either supplied pre-impregnated with solvent (as in some optical wipes) or a solvent is added just before use. The solvent must be of a high purity to avoid leaving a residue and a dry cleaning operation must follow immediately so that it does not have time to dry on the connector ferrule. Isopropyl alcohol is often used but there are also some good proprietary solvents.

## 5.1.4 Cleaning Flowchart

The flowchart below covers the process of cleaning and inspecting connectors before mating. It also shows the escalation of the cleaning method from dry cleaning to wet cleaning with solvents.



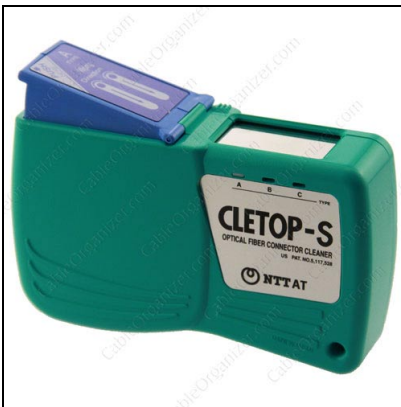
## 5.1.5 Cleaning tools

### Fibre Inspection microscope



Battery-powered microscope with 200x magnification. Requires different adapters for different connector types. Must never be used to examine 'live' fibres.

### Cletop-s Cassette cleaner



Highly effective method of cleaning a free connector ferrule. Contains a cassette of anti-static cleaning cloth. Pressing the blue lever exposes a fresh length of material. Not suitable for wet cleaning.

### 'One-click' Ferrule cleaner



Required for cleaning recessed ferrules but can also be used on free connectors. Automatically wipes the ferrule end-face when it is pushed into the connector receptacle. Can be impregnated with solvent for wet cleaning.

## 5.2 INTERROGATOR

The interrogator contains no user serviceable parts and should be returned to Smart Fibres UK or their local representative for maintenance or repairs.