

# Advanced digital solutions to monitor and control stored grain conditions

The iGrain portfolio of products offers a complete solution for monitoring temperature, moisture and spoilage prevention, using advanced digital technology and automated controls to optimize the condition of stored grain in silos, flat storage warehouses, and grain piles. We are proud developers of this technology in our headquarters in Denmark and our products and systems are installed and performs in Europe, the Middle East, the Far East, Asia, Russia, North- and South America and Africa.



## Temperature monitoring

The iGrain temperature cables use advanced digital sensors encased in a durable sensor cable. This digital technology is proven to be highly accurate with a long service life, resulting in lower maintenance, higher reliability and lower total cost of ownership than other types of temperature cables. Data from the temperature cables can be sent to almost any kind of PC loaded with iGrain software. It is also possible to connect to PLCs, SCADA systems or a handheld reader. Temperature lances are another alternative for temperature monitoring using the same advanced digital sensors packaged in a compact spear. As they are highly portable, temperature lances can be used in flat storage warehouses or piles for checking smaller storage sites. The lances are simply inserted into the grain, and the temperature data is sent to a handheld reader. Up to 99 lances can be connected in one local network using just a single handheld reader for data collection from all sensors.



## Moisture monitoring

The iGrain digital moisture sensing cables measure ambient relative humidity at several points in the grain silo and use the data to calculate grain moisture using an Equilibrium Moisture Concentration (EMC) curve. In most silos, a single moisture cable is all that is needed to monitor grain moisture content. Accurate, digital moisture measurement helps control losses due to spoilage that can occur if excessive moisture is present - or shrinkage, due to moisture loss caused by excessive aeration. Moisture sensor lances are available as well, similar to temperature lances.

Moisture sensor lances also reads temperature and it can be connected to e.g. a hand held reader or a PC system with iGrain software. The iGrain Hand-Held readers read up to 49 moisture sensors.



## Spoilage Detection

The iGrain Grain Sniffer detects spoilage in grain by monitoring the level of CO<sub>2</sub> in the silo caused by biologic activity, that is a result of insect infestation or fungus in the grain. A key advantage to the Grain Sniffer CO<sub>2</sub> monitor is that CO<sub>2</sub> travels relatively fast, often detecting spoilage faster than temperature monitoring. Because CO<sub>2</sub> is a gas, it can travel through the grain mass and it can be detected at very low levels.

FUNGUS ATTACK



GRAIN WEEVIL ATTACK



## Level

The iGrain Grain RADAR Unit is a very precise measurement system for measuring grain levels with a very high accuracy of a few centimeters. In connection with the iGrain Inventory Manager Software the Radar Unit provides: Level Measurement, Inventory Trend Curves, Theft and Spoilage monitoring etc.



## iGrain Dashboard Manager

The iGRAIN DASHBOARD MANAGER is the platform from where all storage and monitoring data can be displayed in a comprehensive overview. The Dash Board "Front Page" literally contains all information about the stored grain condition and all control data: Grain Temperature, Grain Moisture, Grain Level, Grain Volume, Grain Weight, Weather Data, Aeration ON/OFF Status, Spoilage Indication and Grain and Ambient CO<sub>2</sub> Concentration. Data read out can be on a System PC, tablets or on smart phones.



## Aeration

The iGrain software offers an Aeration Control Module that controls both the main aeration fans and roof exhaust fans. The system uses temperature and moisture data from sensor cables and data from the weather station, to optimize aeration and avoid infestation. The system can target a specific temperature and grain moisture.

# iGRAIN TEMPERATURE SENSOR CABLE

## ADVANCED DIGITAL GRAIN TEMPERATURE MONITORING



### General description

The iGRAIN TEMPERATURE SENSOR CABLE has become the grain industry bench-mark for rugged, durable and precise grain monitoring.

The Sensor Cables come in 3 different versions with different tensile strengths.

Several different suspension systems are available to match any type of grain silo. Whether your tasks are in steel bins or concrete silos iGRAIN offers a solution with our Sensor Cables. They are easy to install and to service.

For steel silos we recommend mounting of the Sensor Cables on top of the roof, and we have developed different solutions for that.

We also have systems for suspension inside the bins, where the Sensor Cables are hanging from the roof rafters or from steel wires suspended under the roof. (Ask for our suspension application info).



Suspension Hook to hang from silo rafters



iGrain Sensor Cable Head



End Fitting



### ADVANTAGES

- Superior digital technology
- 2-wire system
- NO temperature drift over 10 years
- 4 Different suspension systems

### Technical specifications

|                      |                                                                   |
|----------------------|-------------------------------------------------------------------|
| <b>Sensor Cables</b> | Diameter 10.8mm, tensile strength 2.500 Kg, max. 30 Meter length  |
|                      | Diameter 13mm, tensile strength 3.500 Kg, max. 50 Meter length    |
|                      | Diameter 17mm, tensile strength 6.500 Kg, max. 80 Meter length    |
| <b>Sensors</b>       | Temperature Range: -20 to +70 deg. C, resolution 0.3 deg. C       |
|                      | Up to 52 sensors in each Sensor Cable                             |
|                      | Mounting eye at the bottom of the Sensor Cable for floor fixation |

# iGRAIN MOISTURE SENSOR CABLE

ADVANCED GRAIN, MOISTURE AND HEADSPACE MONITORING



## General description

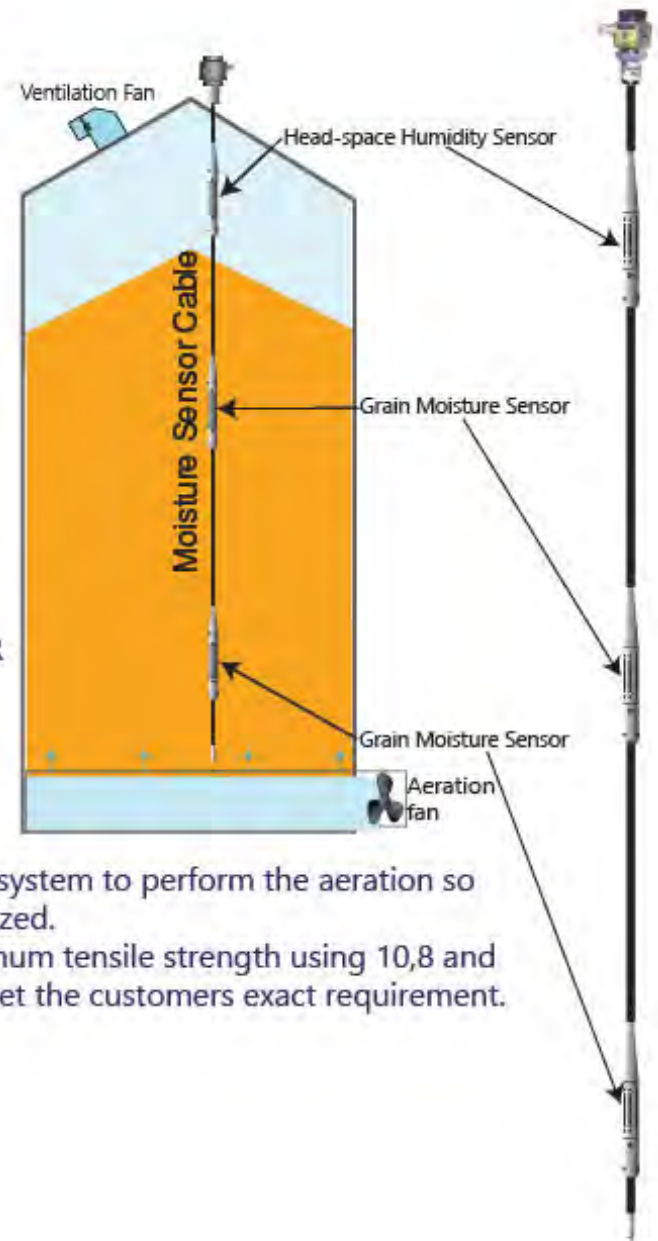
The iGRAIN MOISTURE SENSOR CABLE is an advanced grain monitoring tool. It measures the ambient relative humidity at different points in the grain bin. The relative humidity can be calculated into grain moisture using the EMC curve (Equilibrium Moisture Concentration).

Usually the top sensor is placed just under the silo roof so the head space relative humidity is monitored and applied in the iGRAIN MANAGER SOFTWARE to control the roof vent fans.

Since small fluctuations in the EMC value corresponds to a very specific calibration curve, it is important that the user selects the correct grain type from the set-up menu, in the iGRAIN MANAGER SOFTWARE.

In the iGRAIN MANAGER SOFTWARE the trend curves for the grain moisture can be seen.

Recording of the grain moisture enables the iGRAIN system to perform the aeration so that shrinkage due to loss of moisture can be minimized. The Moisture Cables are available for different maximum tensile strength using 10,8 and 13 mm conduit cable and it can be configured to meet the customers exact requirement.



## ADVANTAGES

- **Avoid shrinkage through moisture monitoring**
- **Reliable GRAIN moisture tracking**
- **Connects to the standard iGRAIN network boxes MASTER-HUB and SUB-HUB**

## Technical specifications

The moisture Sensor Cables are connected to a PC with the iGRAIN DASH BOARD MANAGER Software. The communication with the sensors is by means of the iGRAIN data network via the Master-Hub(s) and Sub-Hubs. The Master-Hub collects data from the Sub-Hubs that are connected to the moisture cables.

Sensor Cables: Diameter 10.8mm, tensile strength 2.000 Kg, max. 24 Meter length, max 3 sensors  
Diameter 13mm, tensile strength 3.000 Kg, max. 35 Meter length, max 7 sensors  
Each Sensor cable may have from 1 to 4 Moisture sensors  
There is a fixation eye at the bottom of the Sensor Cable

Sensors: Grain Moisture: 8 to 24% Moisture,  
Head Space Humidity sensor: 2 – 99%rH

# iGRAIN ALL-IN-ONE SENSOR CABLE

ADVANCED TOTAL GRAIN MONITORING



## General description

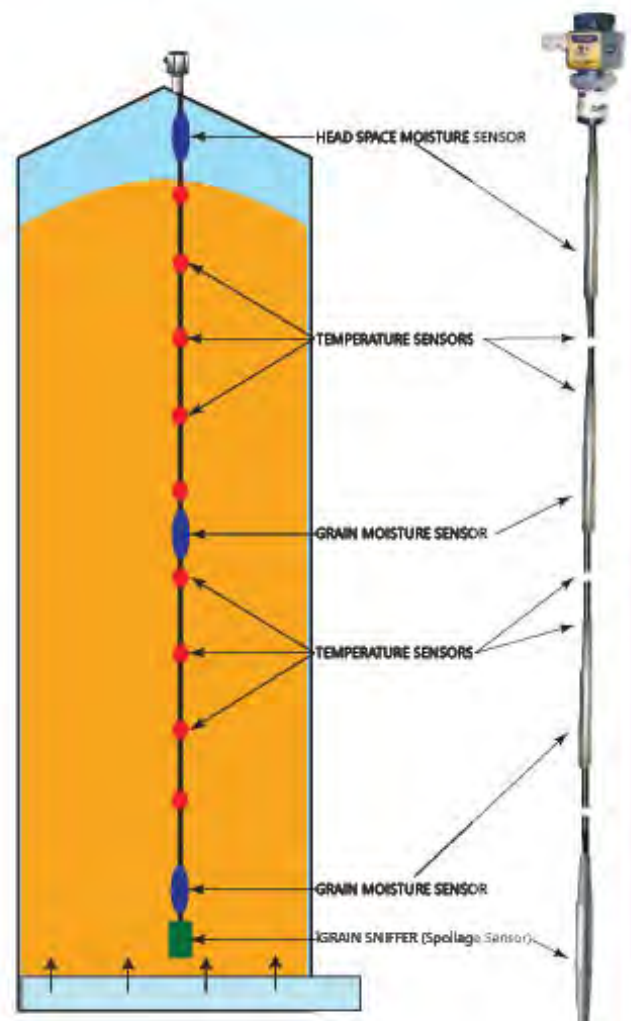
The iGRAIN ALL-IN-ONE SENSOR CABLE combines several different digital sensor technologies into one Sensor Cable. It provides the user with a cost efficient TOTAL MONITORING and may be used as the only monitoring in a single bin, or supplemented with some additional temperature monitoring Sensor Cables.

The ALL-IN-ONE Sensor Cable Monitoring:

- Temperature Monitoring
- Grain Moisture Monitoring
- Bin head space Moisture Monitoring
- Grain Level Monitoring
- iGRAIN SNIFFER CO<sub>2</sub>-Monitoring (option)

The ALL-IN-ONE iGRAIN Tablet PC control system:  
Basically the entire iGRAIN MANAGER SOFTWARE

- Temperature Monitoring, matrix and trend view
- Grain Moisture monitoring
- Spoilage detection
- Automatic aeration control incl. roof vent control
- Inventory management system



## ADVANTAGES

- **Total advanced monitoring with a simplified system**
- **Intelligent use of sensor technology reduces the monitoring requirement**

## Technical specifications

**Sensor Cable:** Temperature monitoring: one sensor every 1.50 m,  
Measure range: -20 + 70 Deg. C  
Grain Moisture sensors: 8 – 24% H<sub>2</sub>O  
Relative humidity in bin head space: 5 – 99% rH  
Spoilage detection CO<sub>2</sub> sensor: 0 – 10000ppm  
Level monitoring resolution 1.5 m, (24h delayed level update)

**iGRAIN Control SMART-SYSTEM** Control cabinet with fixed mount tablet PC, WIN10-PRO, IP-65 thermostatic cabinet  
Aeration control output (option), including roof vent control  
One iGRAIN CONTROL SMART SYSTEM connects to max 12 bins, (12 AIO Cables)

# iGRAIN SENSOR CABLE - SUSPENSION SYSTEMS

MOUNTING SYSTEMS TAILORED TO ALL TYPES OF SILOS

## Suspension hooks



The Suspension hooks are designed for ease of installation.

The self-locking bolts ensures that they never loosen and risk falling down.

Independent of the roof rafter type it is normally easy to find a way to use either an existing opening in the rafter, or to drill a hole in the rafter. Some silo manufacturers provide standard fitting for the Sensor Cable mounting.

Please contact our application engineers for further information if required.

## Silo roof mounting plate



The mounting plates come in many varieties, designed for mounting on 30° steel roofs and on flat concrete roofs.

The mounting plates for 30° steel roof are designed for firm attachment to the roof sheets for displacement of the pulling force to the roof sheets.

The roof mounting plates may also be mounted on a support structure for displacement of the pulling force to the roof bars.

iGrain can tailor special mounting systems for your exact requirement.

# ADVANCED GRAIN SPOILAGE DETECTION

## ADVANCED GRAIN SPOILAGE DETECTION



### General description

The iGRAIN SNIFFER is an advanced CO<sub>2</sub> sensor system that will detect stored grain spoilage at an early stage. It supplements temperature monitoring, and will often find a HOT-SPOT before temperature monitoring.

It is based on detecting any unwanted biologic activity from insects, fungus etc. in the stored grain.

Because CO<sub>2</sub> is a gas it will migrate through the grain mass so only one sensor is required in each bin or storage cell.

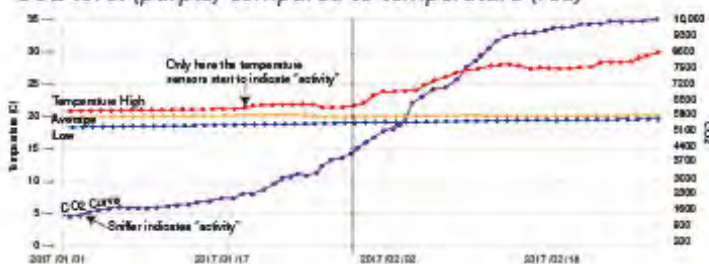
Because the generation of CO<sub>2</sub> from unwanted biologic activity is rather small, and because the ambient level of CO<sub>2</sub> changes, a sophisticated technology is required to detect the rise in CO<sub>2</sub> levels in the early stage.

The iGrain CO<sub>2</sub> sensor cables comes in two versions:

Version 1: extracts the air from inside the grain by vacuum to the CO<sub>2</sub> sensor located in the cable head compartment.

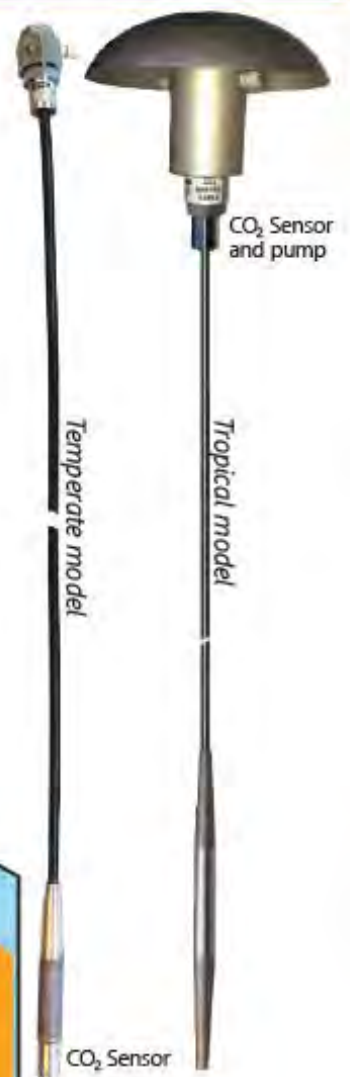
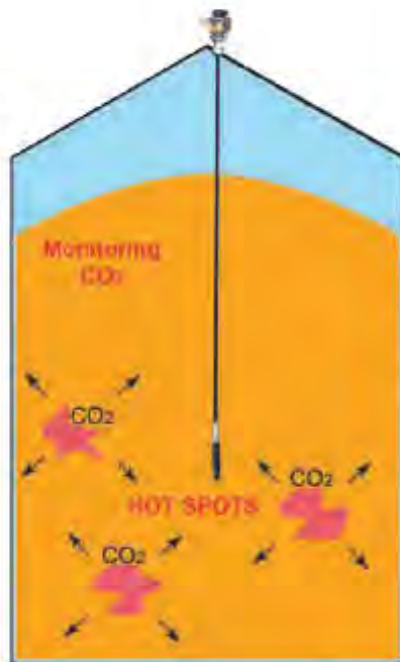
Version 2: Measures the content of CO<sub>2</sub> by a sensor(s) placed on the cable and inside the grain.

*The curves indicates fast detection of increasing CO<sub>2</sub> level (purple) compared to temperature (red)*



### ADVANTAGES

- **Earliest possible grain spoilage detection**
- **Reduces losses**
- **Improves possibilities for management to take correct decisions**



### Technical Specifications

Version 1 comes in 2 different models for application in either tropical or temperate climate. Both models communicate via RS-485, Modbus with the iGRAIN MANAGER SOFTWARE.

**Tropical Model** Very accurate spoilage detection  
Measure range: 0 – 10000 ppm, and a response time of less than 15 min.  
Automatic compensation for background fluctuations in temperature or CO<sub>2</sub>

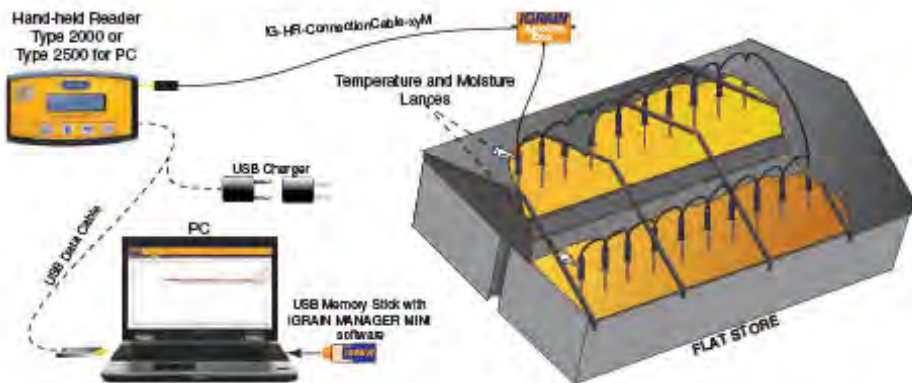
**Temperate** Very accurate spoilage detection  
Measure range: 0 – 10000 ppm, and a response time of less than 60 min.

# iGRAIN TEMPERATURE AND MOISTURE SENSOR LANCE

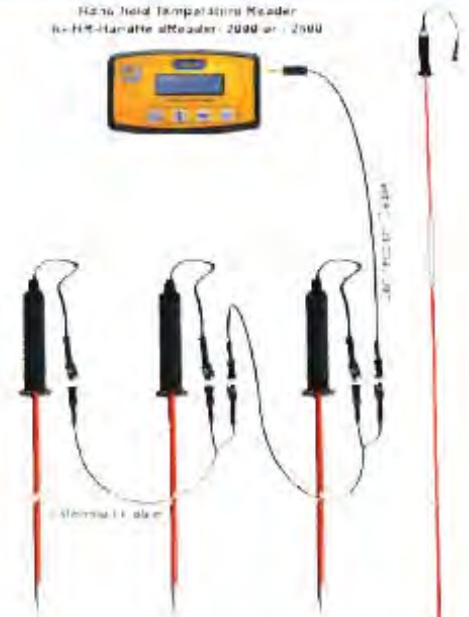
## FOR SPOT CHECKING AND PERMANENT FLAT STORE MONITORING



### Hand Instrument Systems



Hand-held Temperature Reader  
iG-HR-Hand-held Reader: 2000 or 2500



### General description

The iGRAIN TEMPERATURE and MOISTURE SENSOR LANCES are designed with advanced features and come in several configurations. The lances have a rugged handle that makes it easy to insert into the grain. The lance is a flexible fiber glass rod, coated with a smooth surface and it comes in different lengths for various applications. It is ideal for spot-checking smaller storage sites or for permanent monitoring of flat stores or grain piles. The lances can be connected in series and the readings from several lances can be taken at a central data collection point by a Hand-held reader or connected individually to Sub-Hubs for integration into an iGrain Network System.

### Connection Cables

iGrain provides a variety of connection cables for the lances i.e. Lance to Junction Box / Sub Hub, Lance to Hand-Held Reader and Lance to Lance in various lengths and CAT 5-E professional LAN cable all for outdoor installations.

### ADVANTAGES

- **Superior digital technology**
- **Moisture, Temperature and Moisture & Temperature**
- **Flexible fiber glass rods**
- **For Hand-Held Reader and iGrain Network Systems**

Moisture  
Sensor Lance

### Technical specifications

Length and number of sensors:

Temperature

Sensor 1.0 meter length 1 Sensor

Lances 1.8 meter length 2 Sensors

3.8 meter length 3 Sensors

5.8 meter length 4 Sensors

Moisture

1.0 meter length 1 Sensor

3.0 meter length 2 Sensors

6.0 meter length 3 Sensors

Measuring Range: Temperature Range: -20 to +70 deg. C, resolution 0.3 deg. C  
Relative Humidity (moisture): 0 – 99 %

# iGRAIN Temperature and Moisture Reader

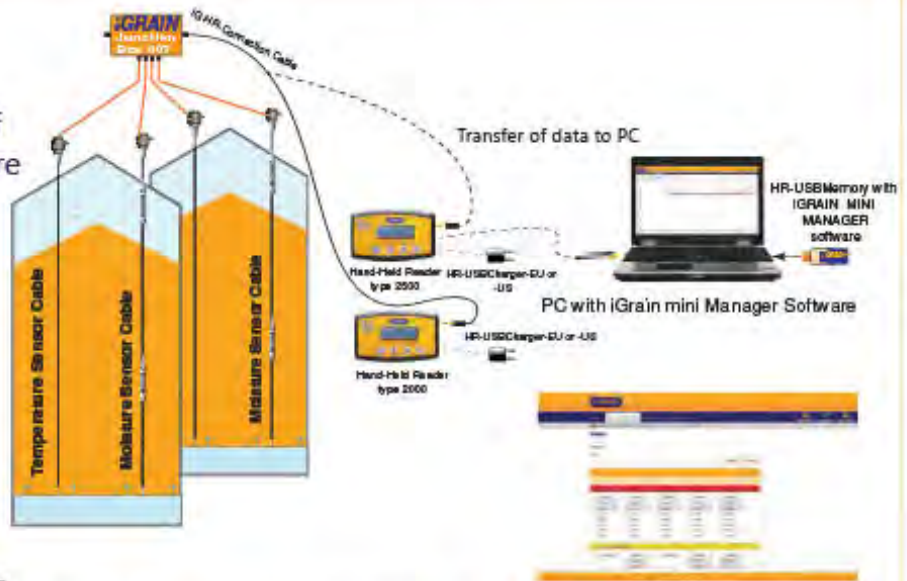
Models 2000, 2500 and 3500 Moisture

## General Description

The iGrain Hand-held Reader is an efficient tool to display the content of data collected from iGrain Temperature and Moisture sensing devices.

iGrain sensor cables and / or lances are programmed with individual lance and sensor numbers and connects in series to the hand-held reader. In all models the readings will be taken by series polling of all devices, and the sensor representing the highest value will be displayed at the end of the polling. It is possible to scroll for displaying all the readings one by one. Model 2500 has the same basic functions as model 2000; but it can also connect to a PC.

With the iGrain Mini Manager software installed on the PC for storing downloaded sensor data the PC will be able to show the readings and trend curves. Model 3500 includes moisture readings and displays grain moisture.



The Hand-held reader is packed in a protective and handy brief-case including: USB charging cable, connection cable with alligator clips, flashlight and an AC mains charger.

## Advantages

- **Temperature & Moisture reading**
- **Universal application**
- **Model 2500/3500 integrates with PC**
- **Model 2000 read out from instrument only**
- **iGrain Mini Manager PC software for display of readings and trend curves**



## Technical Specifications

|             |                                                                                                                                                                                                            |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model 2000: | Reading data from up to 200 temperature sensors or up to 49 Moisture sensors<br>Automatic scrolling of all sensors with display of highest reading.<br>Scroll between sensor cables and individual sensors |
| Model 2500  | As model 2000 + transfer of data to a PC. Includes memory stick with the iGrain Mini Manager PC software                                                                                                   |
| Model 3500  | Same as model 2500 also reading grain moisture                                                                                                                                                             |
| Supply:     | Built-in battery pack 3,7 V 900 mAH                                                                                                                                                                        |
| Display:    | Back-lit display, 2 lines of 16 characters 64 x 20 mm                                                                                                                                                      |
| Weight:     | 220 g.                                                                                                                                                                                                     |
| Dimensions: | (W x H x D) 142 x 88 x 26 mm                                                                                                                                                                               |

# iGRAIN SILO FIRE DETECTION

## FAST RESPONSE FIRE DETECTION MEASURING CO OR CO2

### General description

The iGRAIN FIRE DETECTOR is a versatile unit with a very fast detection of CO<sub>2</sub> inside the silo. The unit comes with a complete roof-mounting-kit and can be retrofitted on top of any storage bin. It provides an ALARM RELAY OUTPUT and a data bus output.

### Operating principle

If the CO<sub>2</sub> is generated by a fire or an emerging fire, the CO<sub>2</sub> increase will be exponential (unlike CO<sub>2</sub> generated by biologic infestation in the bin). It is therefore easy for the system to detect an emerging combustion.

### Monitoring

The iGRAIN FIRE DETECTOR is monitoring the bins at all times. The sensor status is constantly monitored from the host PC. System Alarms are reported immediately. If monitoring of the ambient CO<sub>2</sub> level of 400 ppm fails, then the system alarm is activated.

### Redundancy

The fire detectors are designed for redundant loop line routing of the supply voltage, the analogue alarm and the RS485, which guarantees highest availability and optimal fail-safety. Detectors are powered by separate, redundant and oversized Power Supplies. The RS485 line is redundant and connects to the iGrain System with the iGrain Fire Alarm software installed and it is connected to one or more iGrain Relay Output Unit(s) for visualization of the position of a possible Alarm, that the power is on at all sensors and that all sensors are measuring.

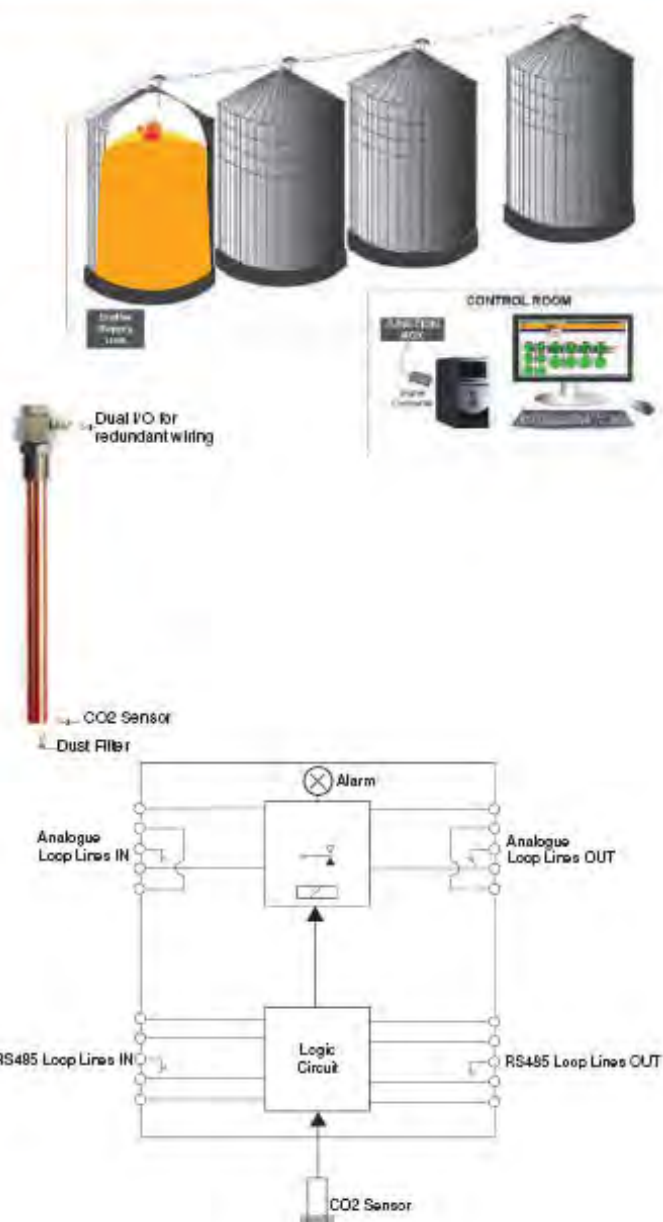
### ADVANTAGES

- **Fast response**
- **Long term stability**
- **Computer monitored**

### Technical Specifications

The iGRAIN FIRE DETECTOR system communicates via RS-485, Modbus with the iGRAIN MANAGER SOFTWARE.

|                        |                                                                                                                                                                                                              |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO <sub>2</sub> sensor | Dual wavelength principle with temperature compensation. Measure range: 0 – 20.000 ppm, (0 - 2%), response time less than 5 sec.<br>Measures constantly the ambient 400 ppm. This confirms active monitoring |
| In/Outputs             | System status, relay and data-output (to PLC). Analogue dual loop line In and Out. RS-485 dual Loop Line In and Out (to PC/PLC). Self Monitoring Alarm Output with visual alarm indicator                    |
| Supply Voltage:        | 5VDC                                                                                                                                                                                                         |



# **iGRAIN RADAR – 80 GHz**

## **High precision level measurement**

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### **General description**

The iGRAIN High Precision Radar level measurement system consist of:

- the BIN-AUDITOR Radar level measurement unit(s)
- the iGRAIN INVENTORY MANAGEMENT SOFTWARE

This system is ideal to keep track of grain inventory status in multiple bins as it interfaces with the iGRAIN Dash-Board Manager control software. Also good for other application.

It is designed for use in grain-, four- or feed silos. It provides an unsurpassed accuracy even in very dusty atmosphere with a maximum measuring distance up to 45 meters.

The advanced microprocessor technology can update level data every minute if needed.

The iGRAIN INVENTORY MANAGER SOFTWARE provides reliable information about LEVEL, VOLUME and grain WEIGHT. It also records all movements IN and OUT of each bin. The system displays Level, Volume and Weight. Grain density can be set by the user for higher accuracy or be chosen from the iGRAIN default density list.



### **Principle of operation**

The Radar emits a narrow microwave pulse that is transmitted downwards by the emitter. The radar reflection from the surface reveals the distance to the surface. The system can be set to zero when the silo is empty. The level can be seen on the unit and is available on both data bus and as analog output.

### **Features**

- Accurate Inventory Information
- Durable system with low maintenance requirement
- NOT sensitive to dust build-up inside the silo !
- Works in dusty environment due to high-frequency transmitter
- Inventory Trend Curves for every bin
- Remote access via iGRAIN MANAGER SOFTWARE Includes THEFT monitoring and Integrates with iGRAIN Inventory Management software
- Easy to install with the special mounting flange
- The small reflection area enhances the echo accuracy, and is beneficial to avoid interference
- Special features secure a higher accuracy than on other similar systems

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### **Technical specifications iGRAIN BIN-AUDITOR Radar Sensor**

|                    |                      |                      |                                   |
|--------------------|----------------------|----------------------|-----------------------------------|
| Measure Range:     | 45 m                 | Data Com.:           | RS 485, Modbus                    |
| Level Accuracy:    | +/- 10 mm            | Analog Output:       | 4 – 20 mA                         |
| Supply voltage:    | 230 VAC/24 VDC       | Communication:       | MODBUS                            |
| Cable Gland entry: | M20                  | Grain Silo Accuracy: | Approx. 1 - 2 %,                  |
| Sensor Head:       | Cast Aluminum, IP 67 | (total volume)       | depending on silo dimensions etc. |

# iGRAIN WEATHER STATION

FAST RESPONSE WEATHER MONITORING FOR AERATION CONTROL



## General description

The iGRAIN WEATHER STATION has been developed to give fast and reliable information about the ambient temperature and air moisture condition.

This is required for efficient aeration control.

The iGRAIN Automatic Aeration Control Software is an advanced system and requires this information to perform the optimum aeration control.

It is important to monitor several weather conditions in order to decide when to start or stop the aeration fans. Depending on the climatic zone, time of the year, storage time and grain moisture. Some of these conditions are:

- Rain starting or stopping
- Near freezing condition
- Sunrise or sunset conditions
- Ambient relative humidity relative to the stored grain moisture

The iGRAIN weather station is developed to suit all these purposes. It is designed for long durability even under harsh conditions such as long and cold winters, hot and warm tropical conditions and desert-like conditions.

It comes with smart accessories, so it is easy to mount in any silo plant at a suitable location.



iG-PRO



iG-STANDARD

| Weather Station                        |                 |
|----------------------------------------|-----------------|
| AMBIENT AIR CONDITION                  |                 |
| 22.6 C                                 | 60% rH          |
| Last 24 Hours Hi/Low                   |                 |
| T Hi: 35.30 C                          | rH Hi: 90%      |
| T Low: 20.60 C                         | rH Low: 60%     |
| Latest Reading:<br>21/03/2017 10:25:40 | Status:<br>Read |

## ADVANTAGES

- **Accurate ambient weather information**
- **Precise ambient humidity sensor**
- **Very durable construction with low maintenance requirement**
- **Suitable for any climate**
- **Remote access via iGRAIN MANAGER SOFTWARE**

## Technical specifications

The Weather Station communicates via a data-bus to the iGRAIN MASTER-HUB that also supplies the power for the unit.

Measure range:                      Relative Humidity: 2 – 99% rH, non-condensing  
                                                 Temperature: -30 - + 70 deg. C

Weather Shield:                      Sun protection shields  
                                                 Rain and snow protection

# iGRAIN ROTARY LEVEL SWITCH

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## General description

The iGRAIN ROTARY LEVEL SWITCH is a rugged switch for general use in all types of bulk silos for level point indication in any commodity like wheat, rice, corn etc. The switch can be installed where required from the side or from the top. Extension rods are available.

Typically, the rotary switch is installed at the maximum/minimum level point in a silo and is used as a signal relay for material handling.

## Principle of operation

When the rotating paddle is covered by grain the rotation is put to a halt. When cleared the motor resumes rotation. It has a unique overload slip mechanism which protects the motor automatically.

## Paddle design

The slim paddle design makes it possible to install the rotary level switch from outside the silo without accessing the inside if this is required.

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## Technical specifications

The level switch iG-LS-06-24V

Supply voltage: 24 Volt DC  
Contact type: SPDT  
Power consumption: 4W  
Speed: 0.85-1 r/min  
Protection level: IP65

Flange:

Flange diameter: Ø 165 mm  
Mounting holes: Ø 18 mm  
Paddle hole: Ø 32 mm

Paddle:

Max paddle diameter: Ø 30 mm  
(Easy insertion through flange)

# iGRAIN NETWORK SYSTEM

## ADVANCED SIGNAL TRANSFER VIA MASTER-HUB AND SUB-HUB

### General description

The iGRAIN TEMPERATURE MONITORING SYSTEM is modular in its design and can be configured to small or big silo installations according to the need.

iGRAIN MASTER-HUB can connect to a maximum of 32 SUB-HUBS.

iGRAIN SUB-HUB has 6 inputs for 6 temperature Sensor Cables or moisture sensor cables.

The system can literally be configured to suit any number of grain bins with any number of Sensor Cables. The MASTER-HUB has a build in display that displays continuously how many SUB-HUBS, Sensor Cables and Sensors it is communicating with. This makes it the preferred system in the industry because the system can be monitored, operated, commissioned, and serviced without the need to connect a PC.

The system interfaces with the iGRAIN DASH BOARD MANAGER software on a PC or in the cloud.

The iGRAIN MASTER-HUB gives an easy overview of all SUB-HUBS and how many sensors are reading in each port.



Sub-Hub



### ADVANTAGES

- **Build in monitoring display**
- **Large capacity**
- **Remote monitoring via internet**

### Technical specifications

|            |                                                                                                                                                                                                                                        |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MASTER-HUB | 4 Input ports for up to 32 SUB-HUBS, and up to 192 Sensor Cables<br>One MASTER-HUB Communicates with up to 1000 temperature sensors<br>MASTER-HUBS can be put in series up to 15 units<br>RS-485 Modbus communication with PC or cloud |
| SUB-HUB    | 6 Inputs from temperature or moisture Sensor Cables<br>Connects to the MASTER-HUB via the iGRAIN data-bus<br>Build in power indicator for easy system check                                                                            |

# iGRAIN IoT

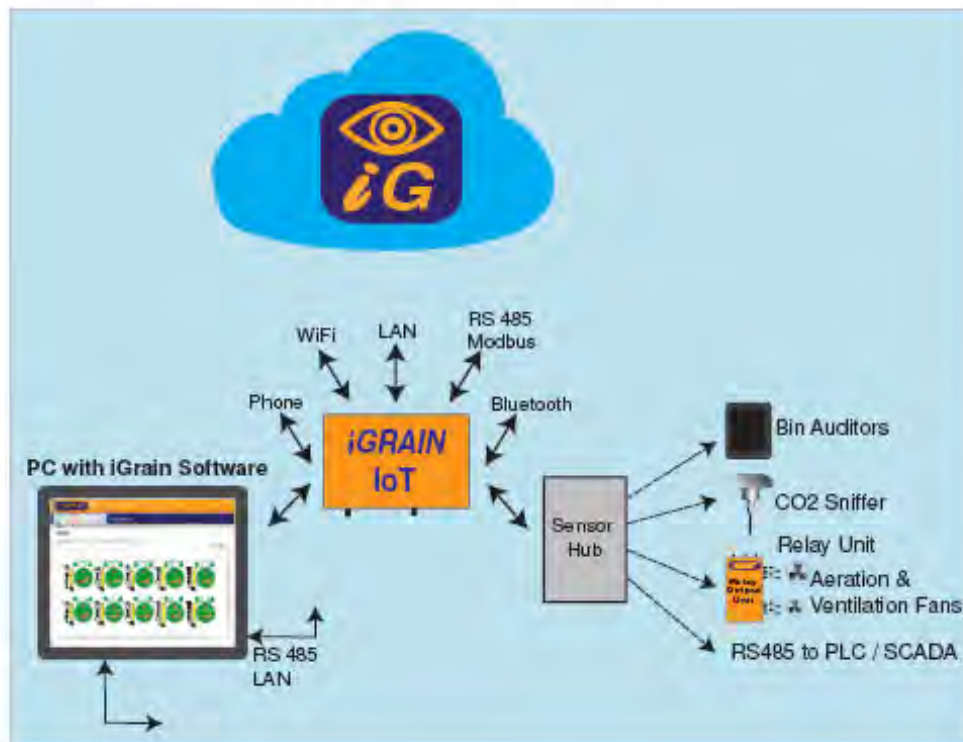
## MULTI COMMUNICATION NETWORK GATEWAY



### General Description

The iGrain IoT Unit is a versatile communication unit that literally integrate all communication gateways and platforms. The Unit communicates with all the different iGRAIN sensors and connects to cloud and local servers, wherever the iGRAIN Dash Board Software or the iGRAIN Smart APP is executed. It also has the capability to end interface with alien sensor systems ( other brands ).

The iGRAIN IoT Unit has the capability to interface with other local IoT Units; or with IoT Units in grain facilities elsewhere. This gives management an easy tool to monitor several sites from any device.



### ADVANTAGES

- Bluetooth  
Communication directly to smartphone
- WiFi connection to local router
- Internet connection via local WiFi or LAN
- Internet via build-in SIM card
- Connection to PLC/SCADA via LAN or RS485/422
- Sensor connection via RS485 to iGRAIN Sensor-Hub's
- Digital Inputs
- Alarm status to smartphone

### Interfaces to iGRAIN Smart APP



### Technical Specifications

|                         |                                       |
|-------------------------|---------------------------------------|
| Communication:          | Bluetooth, WiFi, LAN, SIM, RS-485/422 |
| Serial Baud Rate Range: | 9600 - 115000                         |
| Supply Voltage:         | 24VDC or 100 - 240 VAC                |
| Current Consumption:    | Less than 0,5 A                       |
| Temperature Range:      | -25 to + 50°C                         |

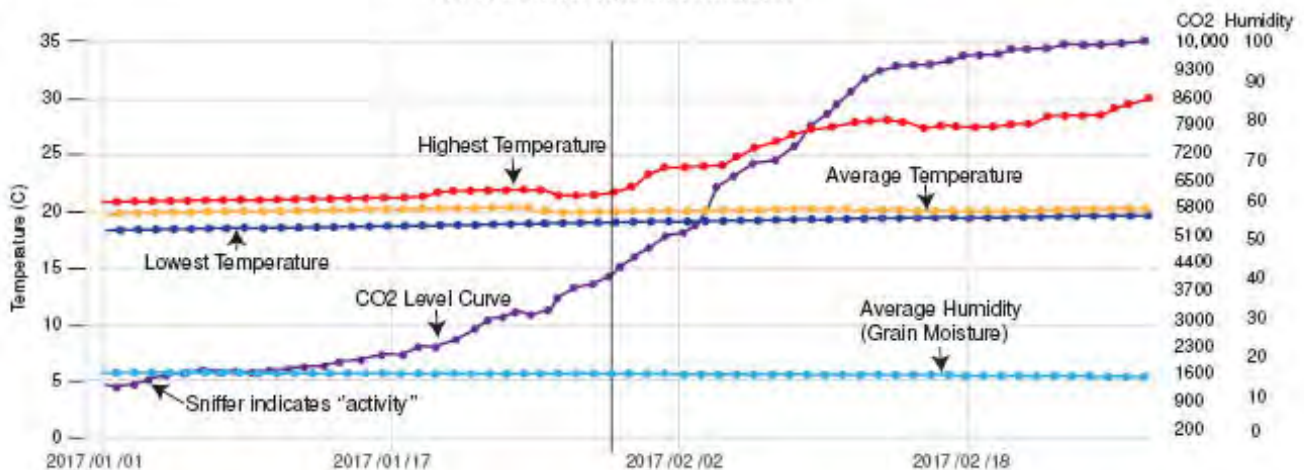
## Trend Curves

Display the highest and the lowest temperature readings in each bin and the average reading of all temperature sensors. If Moisture Sensor Cables are installed in the bins, it will be possible to display the trend curve for the average grain moisture and if CO2 sensors are installed it will be possible to display the curve for the CO2 level in the bins i.e. the "spoilage indication" curve.

The time span (from and to) can be freely selected and the data resolution can be selected as daily average, hourly average or 5 min average. This allows close scrutiny of any data recorded

**Graph Option:** ☐ Show Legend ☐ Show Min ☐ Show Avg ☐ Show Max ☐ Show CO2 ☐ Show Humidity

### Detail Historical Information



## Matrix view

Displays all temperatures in each Sensor Cable, including display of H: High and L: Low. All Sensor Cables are grouped together for each bin. The color of the top bar indicates if all sensors are working correctly in the bin (Green, Light Grey or Red).



### 503 - Type: Rice

| 020303    | 020301    | 020302      |
|-----------|-----------|-------------|
| 8 : 23.20 | 8 : 23.50 | 2 : 43.20 % |
| 7 : 23.00 | 7 : 23.00 | 22.70       |
| 6 : 23.00 | 6 : 23.00 | 1 : 10.20 % |
| 5 : 22.70 | 5 : 22.70 | 22.20       |
| 4 : 22.50 | 4 : 22.70 |             |
| 3 : 22.20 | 3 : 22.50 |             |
| 2 : 22.20 | 2 : 22.50 |             |
| 1 : 18.00 | 1 : 21.50 |             |

# iGRAIN DASH-BOARD MANAGER

## COMPREHENSIVE PLANT STATUS OVERVIEW



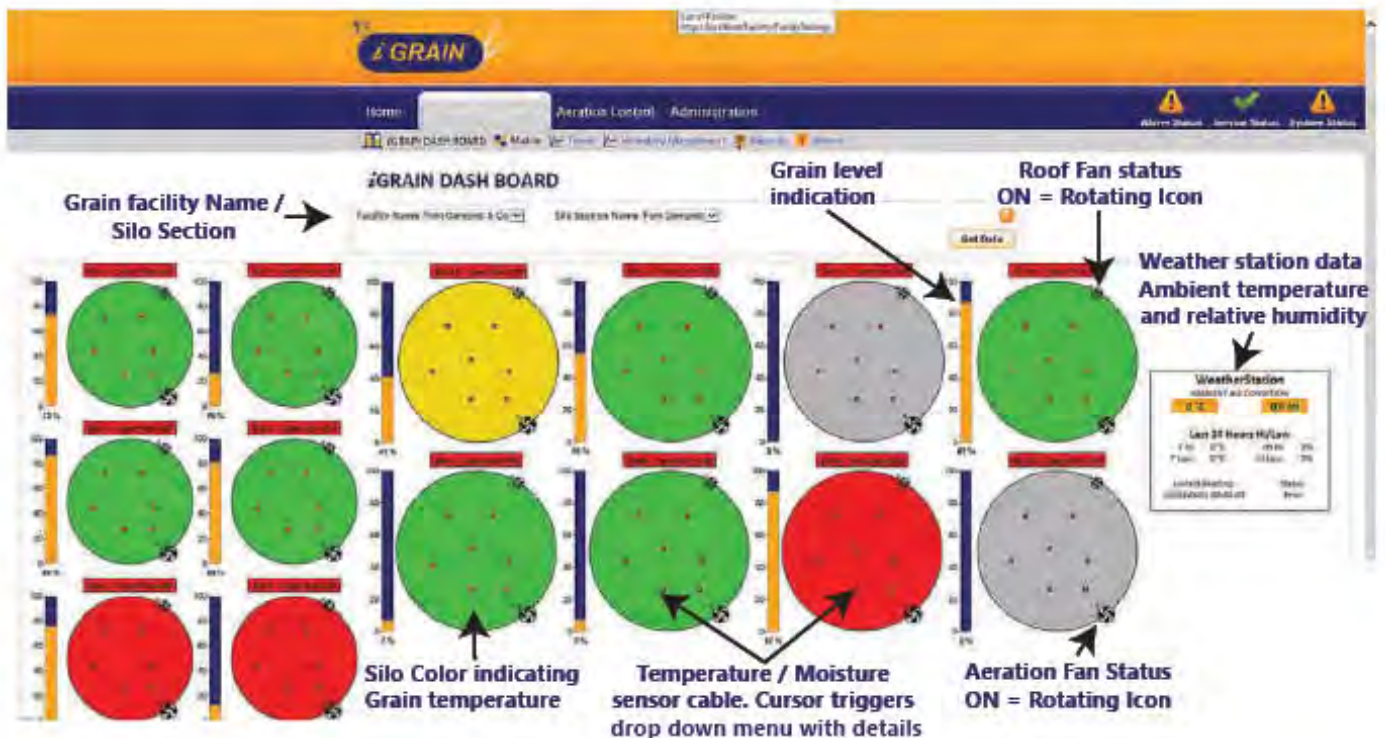
The iGRAIN DASH BOARD MANAGER is the platform from where all storage and monitoring data can be seen in a comprehensive overview. The DASH-BOARD "front page" literally contains almost all information about the stored grain condition and all control data. This could include the following information, depending on system configuration: GRAIN TEMPERATURES, GRAIN MOISTURE, WEATHER DATA, GRAIN LEVEL, GRAIN VOLUME, GRAIN WEIGHT, AERATION FAN on/off STATUS, ROOF EXHAUST FAN on/off STATUS, SPOILAGE INDICATION (iGRAIN SNIFFER CO2 concentration).

The overview data can be examined in more detail by choosing some of the sub menus:

- TREND CURVES
- ALARM SETTINGS
- MATRIX VIEW
- FAN STATUS
- INVENTORY TREND CURVES
- SPOILAGE INDICATION
- SMART APP INTEGRATION

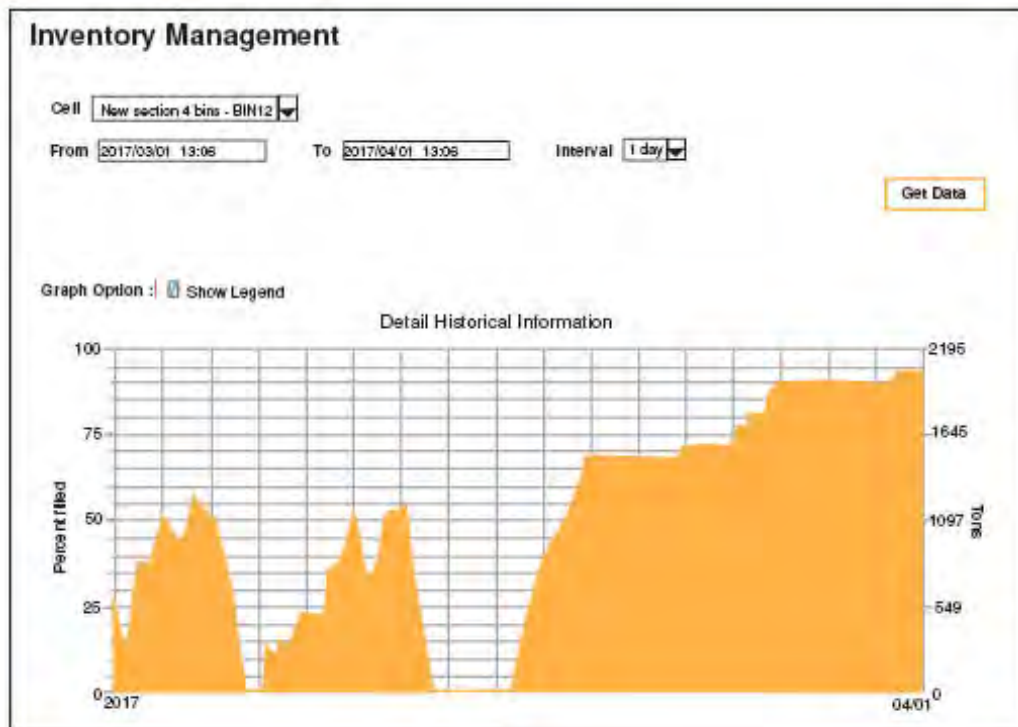


### Dash-Board



# iGRAIN INVENTORY MANAGEMENT

## DETAILED INFORMATION - SUPERIOR OVERVIEW



### General description

The iGRAIN INVENTORY MANAGEMENT SOFTWARE is a unique part to the iGRAIN DASH BOARD software platform.

Display of all vital Inventory Data:

- LEVEL
- VOLUME
- WEIGHT
- MOVEMENTS IN and OUT

The user may generate own commodity names and types e.g. Malting Barley, type A1 etc.

If the same grain type is stored in several cells, then each cell may be displayed individually and may also be stacked for all cells with same grain type.

The software interfaces with any type of level measurement device or any temperature monitoring system and will generate the inventory data in the data-base. The user may access data by entering a specific time interval, e.g. the last 2 weeks, 6 months or the last year. The time period can be scaled up or down as required. If no level sensing device is present, the software can generate level data from temperature Sensor Cables. This is an easy way to get inventory data. The disadvantage is, however that, it will take some time to display changes in the level.

Temperature readings for inventory data cannot be used in bins where the level changes frequently.

The Monday Morning Report will always show the current inventory status and the cumulated change from last week. It will also show the Inventory trend curve for each cell in the last 2 weeks. The report is automatically stored as a .PDF file in the PC and can be printed at any time. The system may also be set to send the report as an e-mail.

### ADVANTAGES

- **Interfaces with all grain level sensors**
- **Generates level data from any type of temperature Sensor Cables**
- **Calculates VOLUME and WEIGHT**
- **Density data from the default data base or the user can enter actual measured density**
- **Documents ALL movements IN and OUT of each storage cell**

# iGRAIN MANAGER REPORT

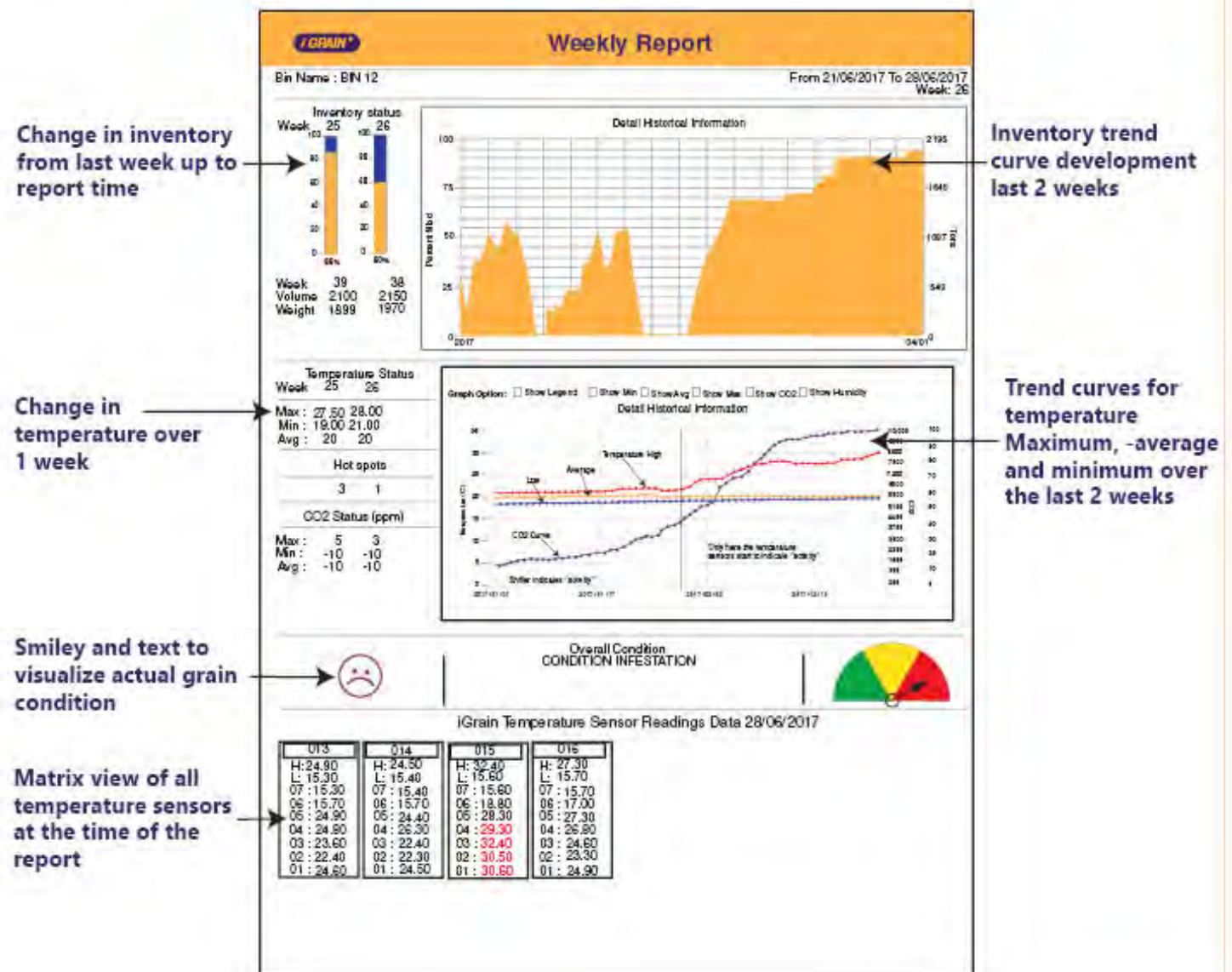
## CLEAR AND DECISION ORIENTED REPORTING

### General description

The iGRAIN MANAGER REPORT is a very efficient management tool. It is printed automatically every Monday morning (or monthly, can be changed in the set-up), and may be sent as e-mail as well. It gives the manager an easy overview of changes in grain condition in every single storage cell:

- Inventory development in the last 2 weeks
- Grain temperature development in the last 2 weeks
- Grain moisture trend, and development in infestation level (CO2 concentration,) if installed
- All grain temperature or grain moisture data at the time of the report
- A smiley with a simple description of the overall grain condition

The report is automatically stored in the system memory and can be viewed at any time.



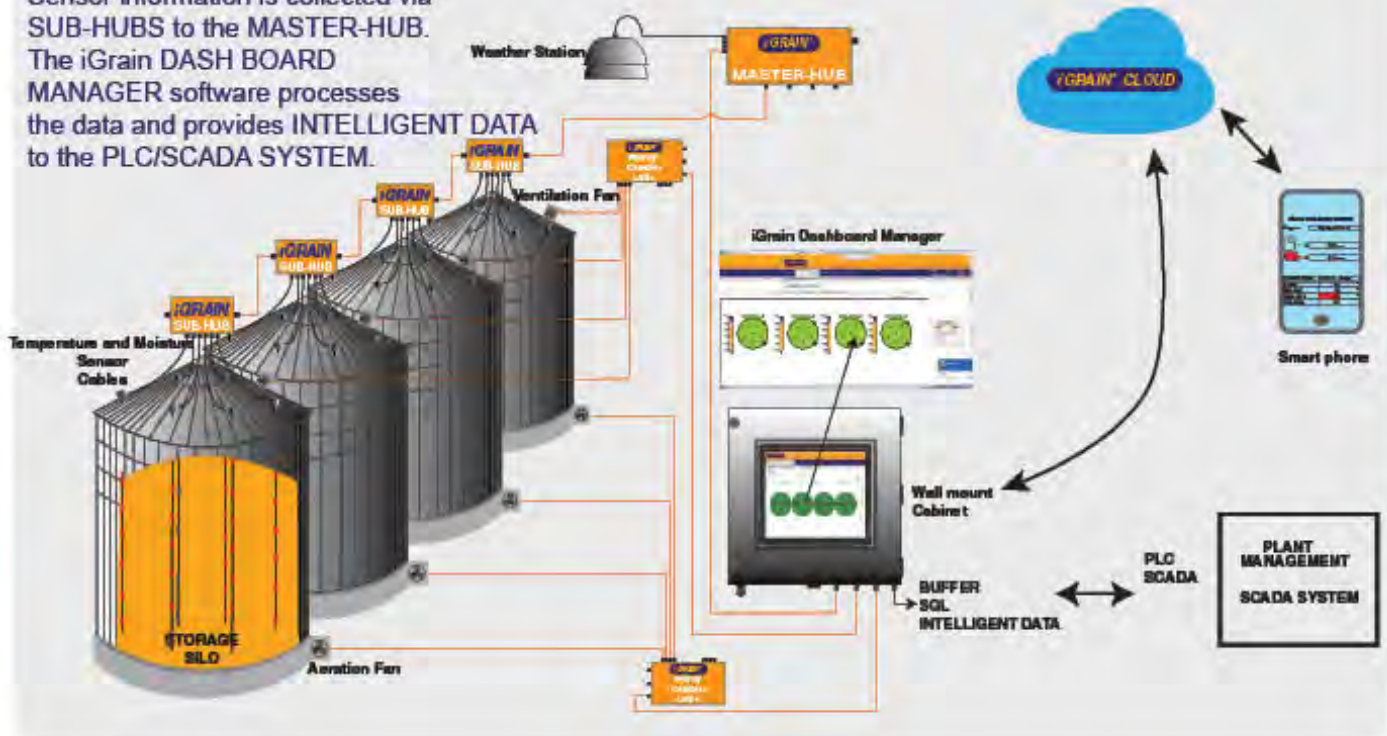
# iGRAIN AERATION CONTROL

## THE KEY TO SUCCESS IN GRAIN STORAGE



### SYSTEM EXAMPLE

Sensor information is collected via SUB-HUBS to the MASTER-HUB. The iGrain DASH BOARD MANAGER software processes the data and provides INTELLIGENT DATA to the PLC/SCADA SYSTEM.



### General description

The iGRAIN DASHBOARD MANAGER PLATFORM software system contains the complete tool for optimum aeration control. It is easy to use and does not require a skilled grain manager to obtain versatile results during storage. It operates in automatic or semi-automatic modes and requires only a few basic settings to start operation. The system utilizes all information from the iGRAIN sensors: Temperature, Moisture, CO<sub>2</sub>, Weather Station data, etc. and it can also integrate data from other sensor systems.

### Aeration Control based on EMC (Equilibrium Moisture Concentration)

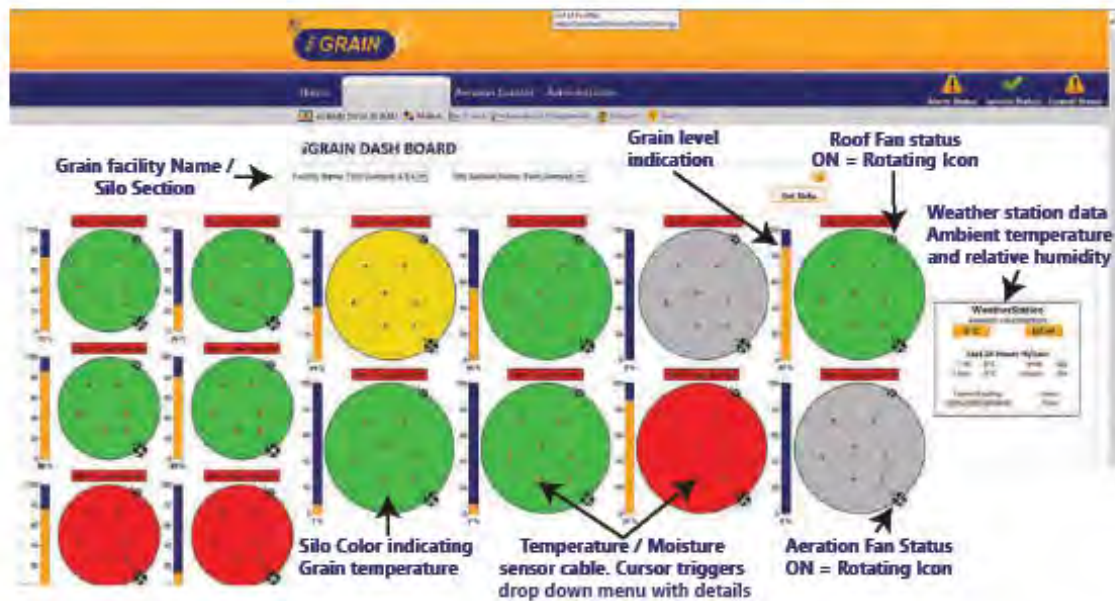
Many suppliers of temperature monitoring systems offer what they think is "Aeration Control". In fact most of them only offer the "thermostat function", meaning that if the temperature is going high they will start the fans. This has nothing to do with Aeration Control. Aeration control must take the total grain condition into account. TRUE AERATION CONTROL, iGrain EMC Aeration control works as follows. The entire grain mass condition is taken into account. Aeration control is based on targeting a specific grain temperature and specific grain moisture. The control system will then find the best control path to get to the target, without putting the grain in danger and only using the fans when it is a calculated advantage. Please do not hesitate to contact us for a more detailed presentation. EMC Aeration Control is definitely the best possible insurance of your grain.

### ADVANTAGES

- Adapts to any climatic zone
- Aeration control reporting included in the weekly "iGrain Monday Morning Report"
- True EMC (Equilibrium Moisture Concentration) aeration control. This means you can target a specific temperature and grain moisture concentration.
- Minimizes moisture losses
- Supplied pre-configured from iGrain
- Online support from the iGrain Online Support Center
- Advanced hierarchic software based on SAFETY FIRST and OPTIMIZING GRAIN VALUE
- Simple system access with passwords

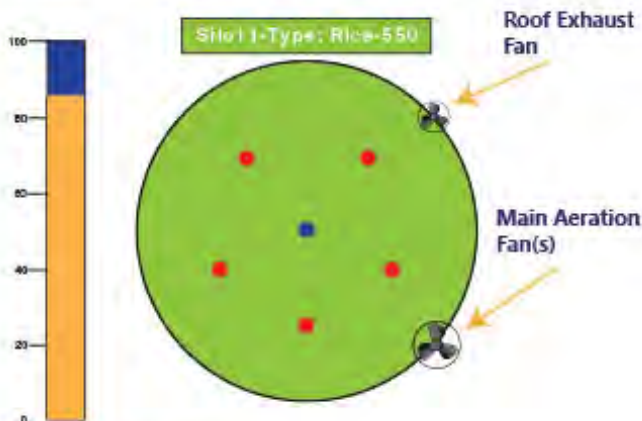
# iGRAIN AERATION MANAGER

## THE ULTIMATE AERATION CONTROL SYSTEM



### General description

The iGRAIN AERATION MANAGER system contains the complete tool for optimum aeration control. It is easy to use and does not require a skilled grain manager to obtain versatile results during storage. It operates in automatic or semi-automatic modes and requires only a few basic settings to start operation. The performance of the AERATION CONTROL can be seen and checked at any time via the iGRAIN DASH BOARD MANAGER Software. The system utilizes all information from the iGRAIN sensors (Temperature, Moisture, CO<sub>2</sub>, Weather Station data, etc.), and can also utilize data from other sensor systems.



### Advanced Fully Automatic Aeration Control

- Fully Automatic - Easy to operate
- Aeration will ONLY be active when it makes sense
- You only select the below parameter

| User select        | Setting options                              |
|--------------------|----------------------------------------------|
| Type of commodity  | 20 Standard commodities available            |
| Active time window | Can be selected, or can be automatic         |
| Target temperature | Set your target = ANY temperature you want*) |
| Target Moisture    | Set any grain target moisture (14,0 %)       |

\*) The settings of the aeration control parameters are made very easy to define in the set-up Menu.

Aeration is performed according to EMC principles so you avoid moisture losses and shrinkage.

### Parameter settings

The settings of the aeration control parameters are made very easy to define in the set-up menu.

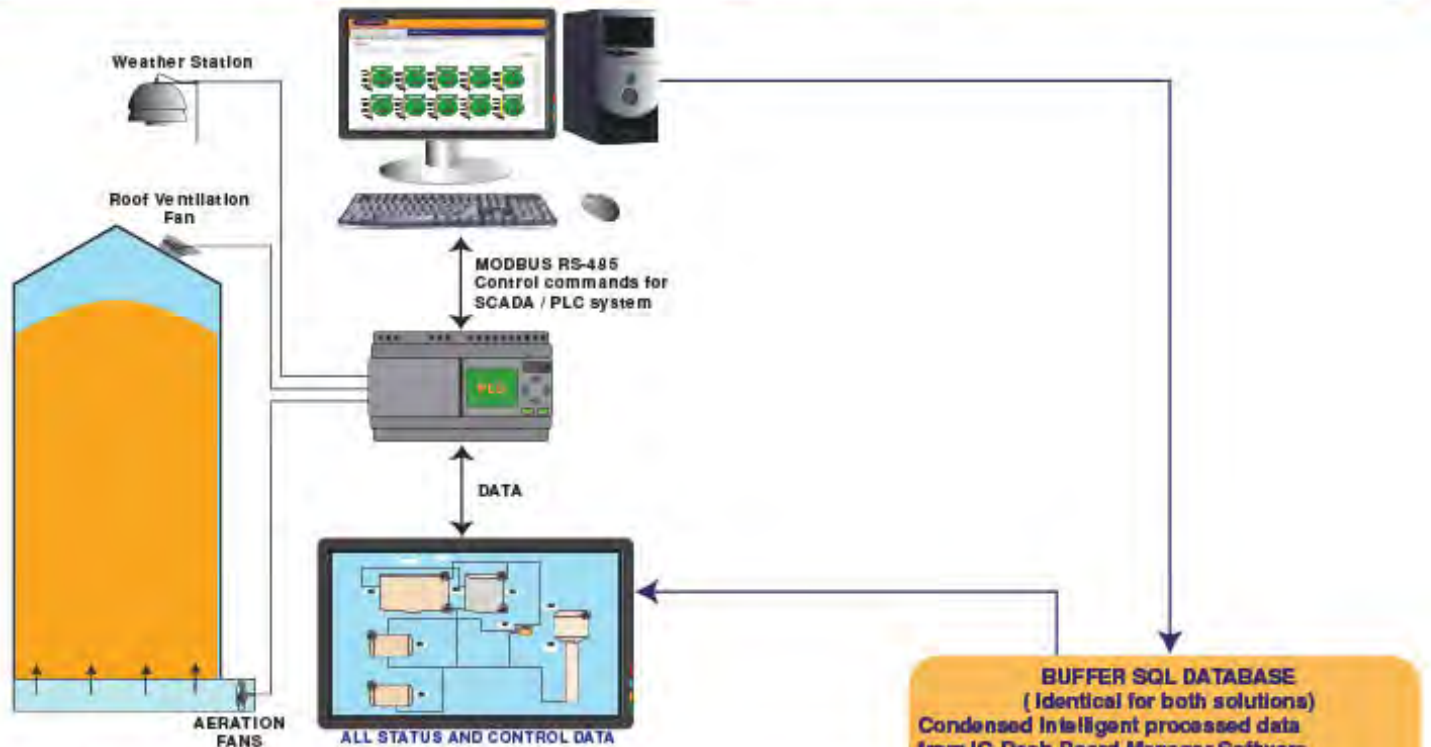
### Control outputs

The system provides communication via RS-485 MODBUS with the iGRAIN relay output modules that may be placed where the Aeration fan start relays are placed and automatic transfer of data to e.g. a PLC.

### Advantages

- Adapts to any climatic zone
- Advanced hierarchic software based on **SAFETY FIRST** and **OPTIMIZING GRAIN VALUE**
- True EMC (Equilibrium Moisture Concentration) aeration control
- Minimizes moisture losses
- Supplied pre-configured from iGRAIN
- iGRAIN On-line Center support
- Aeration control reporting included in the weekly iGRAIN Monday morning report
- Simple access system with passwords

# iGrain Integrated PLC/SCADA Solutions



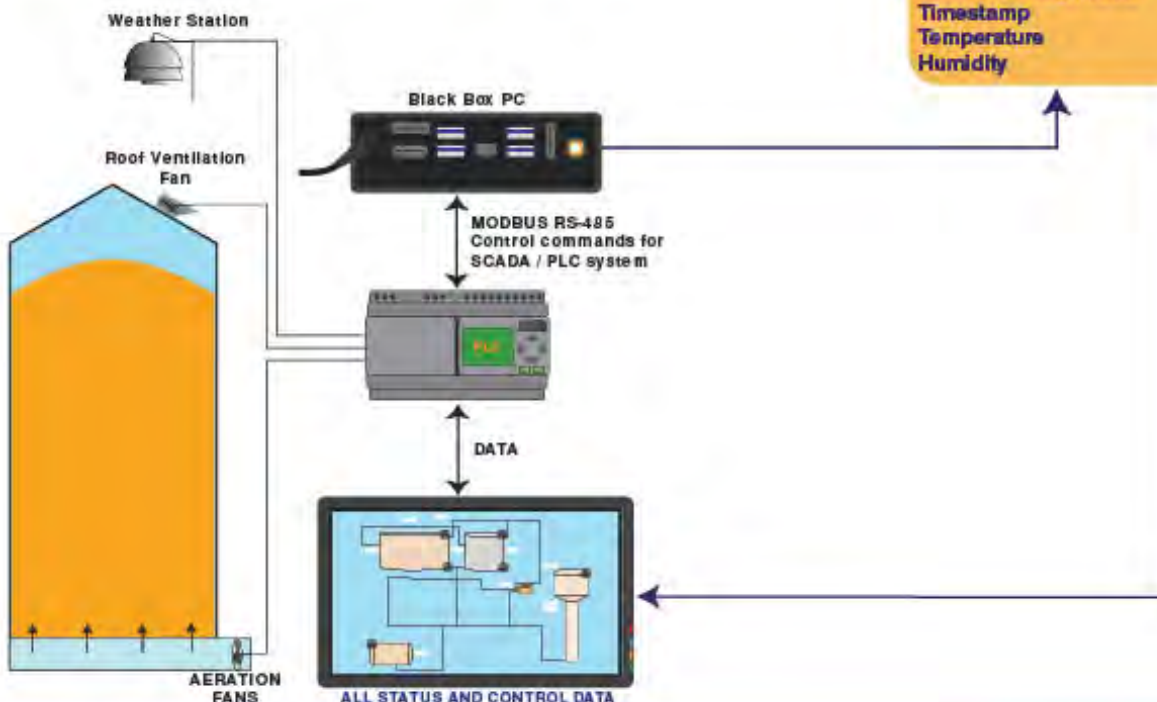
## Technical specifications:

Communicate via RS-485, ASCII from the PC with the IGRAIN MANAGER SOFTWARE.  
Communicate via LAN, Internet from PC with SQL Database.  
Operates in either manual or automatic mode via the automatic aeration control software.

**Data transfer:** RS-485 is sent automatically with a pre-programmed time interval, (20 to 60 min).  
The data string may be polled from the PLC at any time via RS-485, ASCII.

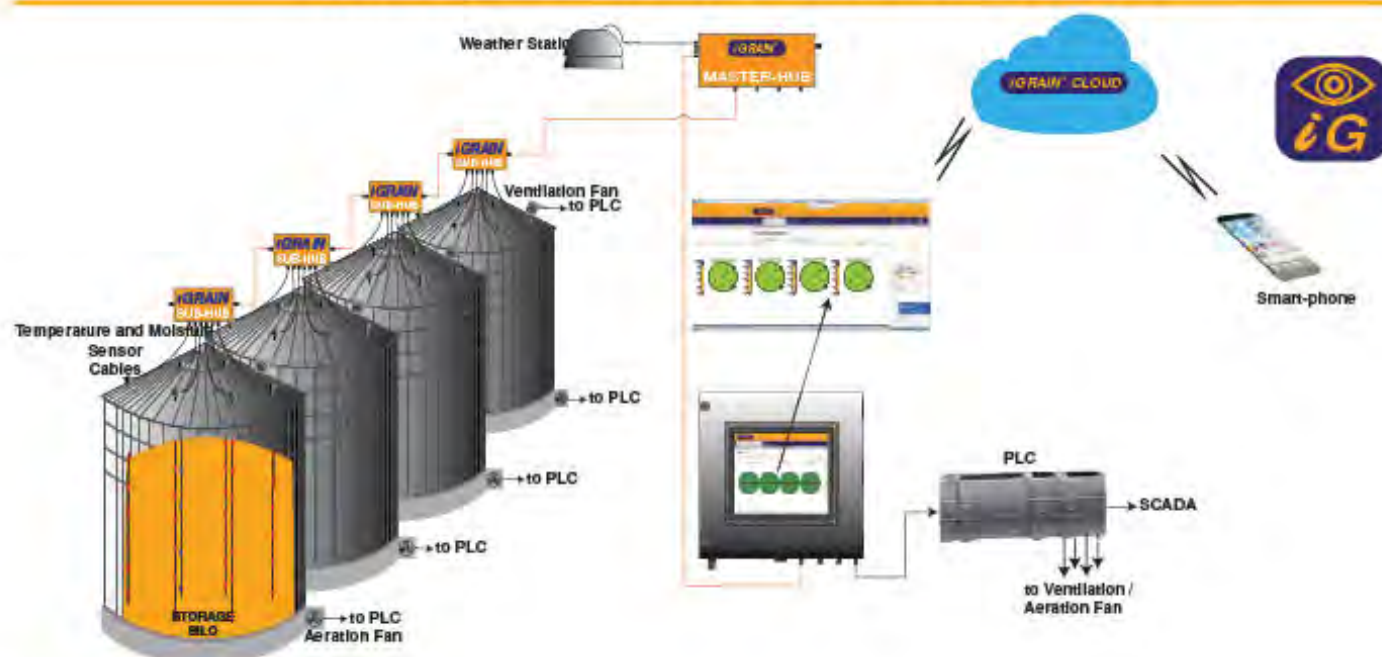
**Data Bus:** LAN Data can be polled from buffer database at any time via LAN.  
RS-485, ASCII, at 9.6 KB baud rate.  
Internet

**BUFFER SQL DATABASE**  
(Identical for both solutions)  
Condensed intelligent processed data from IG-Dash Board Manager Software,  
For use in SCADA for overview  
For use in PLC for Aeration Control purposes:  
**Silo Data:**  
Silo Name (Included Commodity Type)  
Timestamp  
Temperature data (Max, Average, Min in each silo)  
Silo fill percentage  
CO2 Value  
Grain Moisture  
**Control:**  
Main Aeration Fan's ON/OFF  
Roof Exhaust Fan's ON/OFF  
**Weather Data:**  
Weather Station name  
Timestamp  
Temperature  
Humidity



# iGrain Integrated PLC/SCADA Solutions

## INTEGRATING MONITORING AND AERATION CONTROL INTO PLC / SCADA PLANT MANAGEMENT SYSTEMS



### General description

The iGRAIN "PLC Interface" is basically a software string that transfers "overview data" and control outputs for the aeration control to the PLC.

This can also be achieved by the new iGRAIN "Buffer SQL Database", that will make it possible to extract data from the iGrain manager software to a PLC/SCADA solution.

#### This has two advantages

- The control outputs of the aeration fans and roof exhaust fans go into the general control system from where the control (START and STOP) should be done.
- At the same time the important and processed monitoring data of the grain condition and weather condition, is transferred to a SCADA SYSTEM for display of useful overviews.

In this way all vital grain monitoring data is reduced and compiled into simple key data, that can be presented for use in PLC and/or the SCADA SYSTEM.

Control commands can be integrated in the control and bypassed if required according to the specific procedures set-up in the grain facility.

Communication between PLC and PC is made with LAN cable.

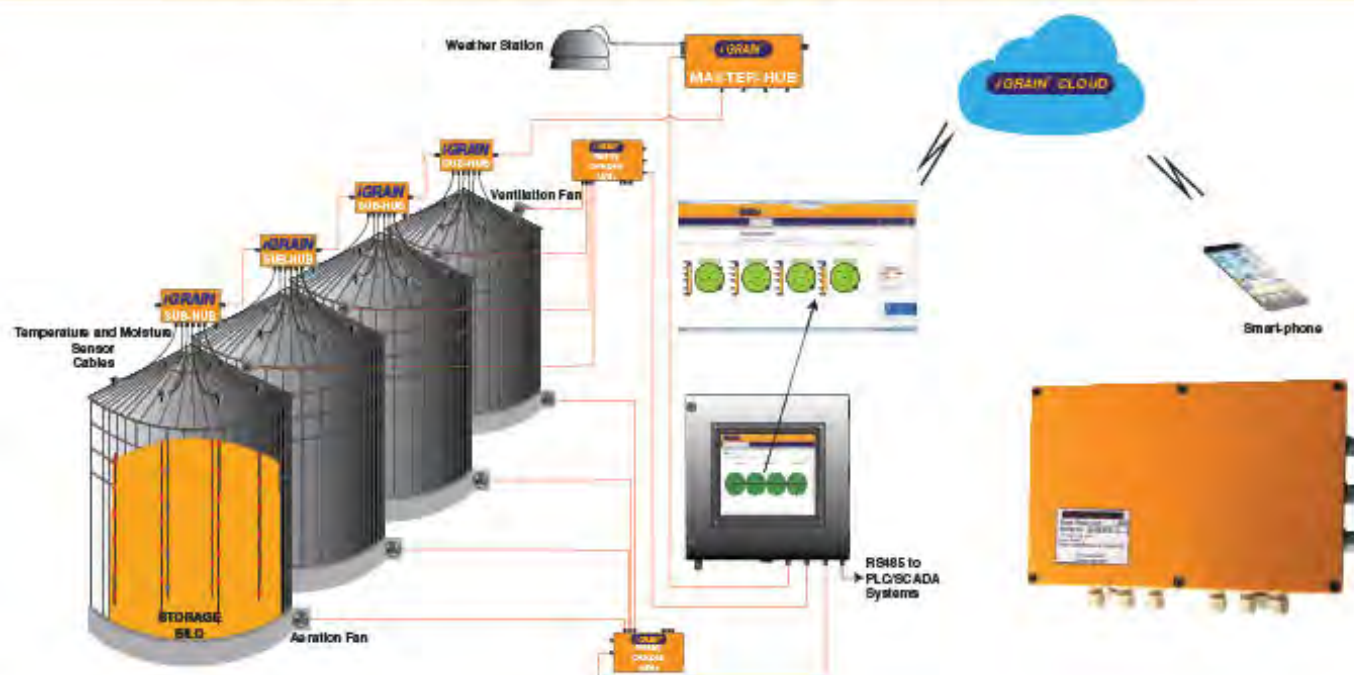
A communication protocol must be made and embedded in the PLC/SCADA system.

### ADVANTAGES

- Integrates iGrain System with the plant MAIN CONTROL SYSTEM, PLC/SCADA
- Transfer of all processed and intelligent data
- Reduces data to operational key information

# iGRAIN RELAY OUTPUT UNIT

## REMOTE CONTROL (VIA MODBUS) OF AERATION FANS ETC.



### General description

The iGRAIN Relay Output Unit is a control device designed for remote control via RS485. Each unit has 8 relays with Normally Open (NO) and Normally Closed (NC) function and the status of each relay is indicated with diodes.

Each unit can be set to an individual address and it can be installed where the aeration power relays are located.

The units can be controlled from the iGRAIN MANAGER SOFTWARE for automatic control the aeration and ventilation fans.



### ADVANTAGES

- Remote control via RS-485 MODBUS
- Status can be monitored via iGRAIN MANAGER SOFTWARE over the internet
- Indoor and Outdoor versions



### Technical specifications

Communicate via RS-485, Modbus from the iGRAIN DASH BOARD MANAGER SOFTWARE. Operates in either manual or automatic mode via the aeration control software.

#### DIN rail unit:

8 Relays, NO (Normally open) and NC (Normally closed) contacts(1PDT)  
Max. power 12 - 24 VDC: 3A and 230 VAC: 10A  
Power supply: 12 VDC, 600 mA  
Protocol: MODBUS address from 00 to 15 via iGRAIN MANAGER SOFTWARE  
RS485; up to 16 Relay Units in series, and up to 1200 m on CAT-5e Cable

#### Cabinet unit:

Die-cast aluminium cabinet: class IP 65. Dimensions: 170 x 240 x 80 mm  
Power supply: 100 – 240 VAC, max 10 W with power ON indicator.

## iGRAIN Online Service Center

THE iGRAIN ONLINE CENTER IS STAFFED WITH GRAIN MONITORING EXPERTS AND YOU CAN GET SUPPORT AT ANY TIME



### Benefits of a Service Agreement:

- The online center provides its services 24-7.
- True experts will check and evaluate your monitoring system at regular intervals.
- Online system monitoring and incident reporting.
- Guidance and recommendations on action or incidents.

### iGRAIN Service Packages

**COMMISSIONING:** Assistance and guidance to installation and commissioning of new systems and extensions.

**EQUIPMENT SERVICES:** 1 and 3 year Support Packages

**1 Year packages** include commissioning support and 1 year system monitoring (including 3 special reports)

**3 Year packages** extend the 1 year package to 3 years with regular checks and reports.

**GRAIN HOTEL PACKAGE:** The Grain Hotel Package facilitates grain hotels to make reports to their clients and to provide on-going audit on storage cells.

### GRAIN Care Packages

The "WE MONITOR AND REPORT FOR YOU" - package provides monitoring and in-depth expert examination and evaluation of recorded data and provision of reports including guidance and information for correct management decision.

**TOTAL GRAIN CARE** - this package provides daily monitoring of the grain condition, optimized aeration control and reports sent to the client every week.

# iGRAIN SOLUTIONS

## COMPLETE SUPPLY OF STORED GRAIN SOLUTIONS



### iGrain monitoring and aeration control systems

Superior Technology 100% Digital, Temperature, Moisture, Level, CO<sub>2</sub> and Weather. Aeration and Ventilation Control.



The world leading monitoring and control software for stored commodities. The famous iGrain DASH BOARD MANAGER software platform is decision oriented for grain managers. It integrates PLC/SCADA systems.



### iGrain online center support service

Tailored service solutions for all kinds of grain storage. Online 24-7 service and support. Expert management in Grain Care, Aeration Control and Grain Handling for increasing the Grain Quality, minimizing the shrinkage to preserve values and optimize profit.



### Crop-Protector Chilling Machines

High flow efficiency cooling fan compared to other brands. High capacity flow, resulting in more uniform cooling. Unique touchscreen computer makes the machine simple and easy to operate. Water cooling is the only solution in hot climate. Our engineers will support you in getting the most cost efficient solution.



### Crop-Protector Ozonator Machines

Ozonation is much more efficient than traditional fumigation. It eliminates 100% of harmful biological activity in the grain, including INSECTS, FUNGUS, MITES etc. Ozone is safer than traditional fumigates. Ozonation can also eliminate Mycotoxins.

Please do not hesitate to contact us at [info@i-grain.net](mailto:info@i-grain.net) with your special requirements. We have the solutions for any silo plant and the know-how to assist you, no matter how complex your tasks may be.