

Guide to Operations

Ultra-Low Temperature Freezers

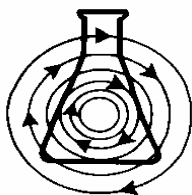
innova[®] Range

(with vacuum insulation panel technology)

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**CAUTION!**

This equipment *must* be operated as described in this manual. If operational guidelines are not followed, equipment damage and personal injury *can* occur.

Please read the entire User's Guide before attempting to use this unit.

HEALTH AND SAFETY AT WORK ACT 1974

(FOR THE UNITED KINGDOM)

New Brunswick Scientific, as manufacturers and suppliers of laboratory equipment, are obliged under the terms of the above Act to provide our users with instructions on the safe installation, operation and maintenance of our equipment.

Our equipment is designed to acceptable standards and does not entail any hazard if used, as advised in the attached instructions.

The following safety precautions should be observed by all personnel using this equipment:

1. Read and understand this manual. If in doubt, contact one of the New Brunswick Scientific Companies listed.
2. Do not remove any covers. There are no operable controls other than those referred to in this manual. There are voltages in excess of 41.5 volts AC behind the covers.
3. Use freezer gloves at all times when loading or unloading the equipment. The temperature of operation is such that direct contact with the cold contents or inside the equipment can burn unprotected skin.
4. Observe good housekeeping practices, at all times keeping the equipment and the adjacent areas clean, dry and uncluttered.
5. Should any malfunctions occur or be suspected, immediately call a qualified service engineer to investigate.

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New Brunswick Scientific Co., Inc. reserves the right to change information in this document without notice. Updates to information in this document reflect our commitment to continuing product development and improvement.

Manual Conventions



NOTE:

Notes contain essential information that deserves special attention.



CAUTION!

Caution messages appear before procedures which, if caution is not observed, could result in damage to the equipment.



WARNING!

Warning messages alert you to specific procedures or practices which, if not followed correctly, could result in serious personal injury.

Bold

Text in boldface type emphasizes key words or phrases.



This particular *Warning* message, whether found in the manual or on the unit, means **HOT SURFACE**—and therefore represents a potential danger to touch.



CRUSH WARNING!

Crush Warning messages alert you to specific procedures or practices regarding heavy objects which, if not followed correctly, could result in serious personal injury .



WARRANTY

Every instrument manufactured by the New Brunswick Scientific Co., Inc. is warranted to be free from defects in material and workmanship. In the USA, this apparatus, with the exception of lamps (where supplied), is warranted for 2 years against faulty components and assembly; and our obligation under this warranty is limited to repairing or replacing the instrument or part thereof which shall, within 2 years after date of shipment, prove to be defective after our examination. Component parts are warranted for 3 additional years (excluding labor). Vacuum Insulation Panels (where present) are warranted for a total of 12 years. This warranty does not extend to any NBS products which have been subjected to misuse, neglect, accident or improper installation or application; nor shall it extend to products which have been repaired or altered outside the NBS factory or its authorized service centers without prior authorization from the New Brunswick Scientific Co., Inc.

Outside the USA, contact your NBS representative for warranty details.



NEW BRUNSWICK SCIENTIFIC CO., INC.

CERTIFICATE OF CONFORMITY

This is to confirm that the following NBS Low & Ultra Low Temperature Freezers:

Innova U101
 Innova U535
 Innova U725
 Innova C585
 Innova C760
 Premium U410
 Premium U570
 Premium C340
 Premium C660

conform to the following European Directives:

Electromagnetic Compatibility (EMC) 89/336/EEC & Amendment 92/31/EEC

Test Standard BS EN 55014-1 : 1997
 Test Standard BS EN 55014-2 : 1997
 Test Standard BS EN 61000-3-2 : 1995
 Test Standard BS EN 61000-3-3 : 1995

Low Voltage Directive (LVD) 73/23/EEC

Test Standard EN 61010-1 : 1993 Amendment A2 : 1995
 Test Standard ISO 5149 : 1993 (E)

Conducted/Radiated Emissions FCC Part 15 Class B

Approved by  on this 21st day of August, 2007
 D J Minister, Executive Designer

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1 INSPECTION & UNPACKING OF EQUIPMENT

1.1 *Inspection of Boxes/Packaging*

After you have received your order from New Brunswick Scientific, inspect the boxes/packaging carefully for any damage that may have occurred during shipping. Report any damage immediately to the carrier and to your local NBS Sales Order Department.

1.2 *Packing List Verification*

Unpack your order, saving the packing materials for possible future use. Also be sure to save the User's Guide, for instruction and reference.

Verify against your NBS packing list that you have received the correct materials, and that nothing is missing.

If any part of your order was damaged in transit, is missing, or fails to operate, please fill out Customer Satisfaction Form 6300 and return it by fax or mail. You can also call the New Brunswick Scientific Service Department or your local NBS representative.



CAUTION!

Inspect the freezer cabinet panels for punctures or other damage that compromises the integrity of the freezer

Any unauthorized punctures or other damage deliberately made to the cabinet walls will invalidate the warranty.

2 INTRODUCTION/OVERVIEW

This manual provides the user with the necessary information for installation and operation of the Innova range of Ultra-Low Temperature freezers with vacuum insulation panels. It also provides some preliminary user maintenance information.

2.1 Description of Equipment

The New Brunswick Scientific range of Innova freezers is designed to provide precise, ultra-low temperature environments for scientific and medical use.



CAUTION!

Vacuum insulation panels are used in the construction of these freezers. These panels are mounted in the cavity against the steel outer wall of the freezer. Any drilling or puncture to the outer wall could release the vacuum from the panel, resulting in impaired freezer performance.

There are two types of Innova freezer: Upright (*see Figures 1 & 3 below*) and Chest (*see Figure 2 below*). This manual covers all versions of these freezer models:

| <i>Upright Freezer Model</i> | <i>Capacity</i> |
|-------------------------------------|------------------------------|
| U101 | 3.6 cubic feet (101 liters) |
| U535 | 18.9 cubic feet (535 liters) |
| U725 | 25.6 cubic feet (725 liters) |
| <i>Chest Freezer Model</i> | <i>Capacity</i> |
| C585 | 20.7 cubic feet (585 liters) |
| C760 | 26.9 cubic feet (760 liters) |

The freezers are totally free of CFCs (Chlorofluorocarbons) and HCFCs (Hydrochlorofluorocarbons). They use HFCs (Hydrofluorocarbons) as refrigerants.

The interior panels and shelves are made of corrosion-resistant stainless steel, making them easy to keep clean and to sterilize.

A membrane keypad and digital temperature readout are provided on a small control panel. On the upright models, this is located on the door. On the chest models, it is located on a console at the right-hand side of the equipment. (*See Figures 1, 2 & 3*)

Controls for setting the freezer temperature and alarm warning setpoints are enabled by an electronic lock. A unique code, which is selected by the user through the membrane keypad, sets this lock. The code can be changed at any time, provided the current setting of the lock is known. **On delivery, the lock code is "0000" (unlocked).**

Indicator lamps on the control panel provide warnings of power loss, system failure, exceeding Hi/Low temperature setpoints, low battery voltage and filter blockage. There is also an LED to indicate when the freezer is under remote control via the RS-485 optional computer interface.

Figure 1 shows a typical upright freezer, Figure 2 shows a typical chest freezer, and Figure 3 shows the upright U101 freezer.

Figure 1: Upright Freezer—Side and Front Views

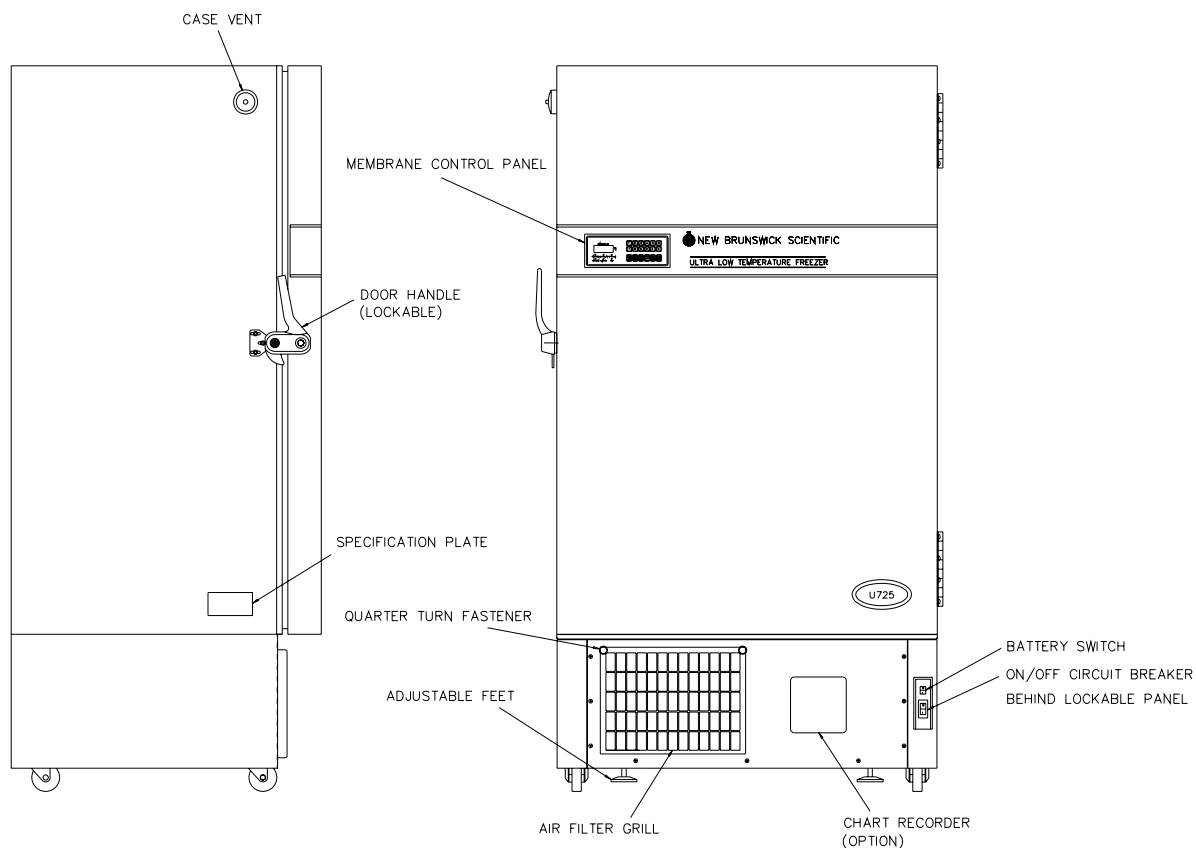


Figure 2: Chest Freezer—Side and Front Views

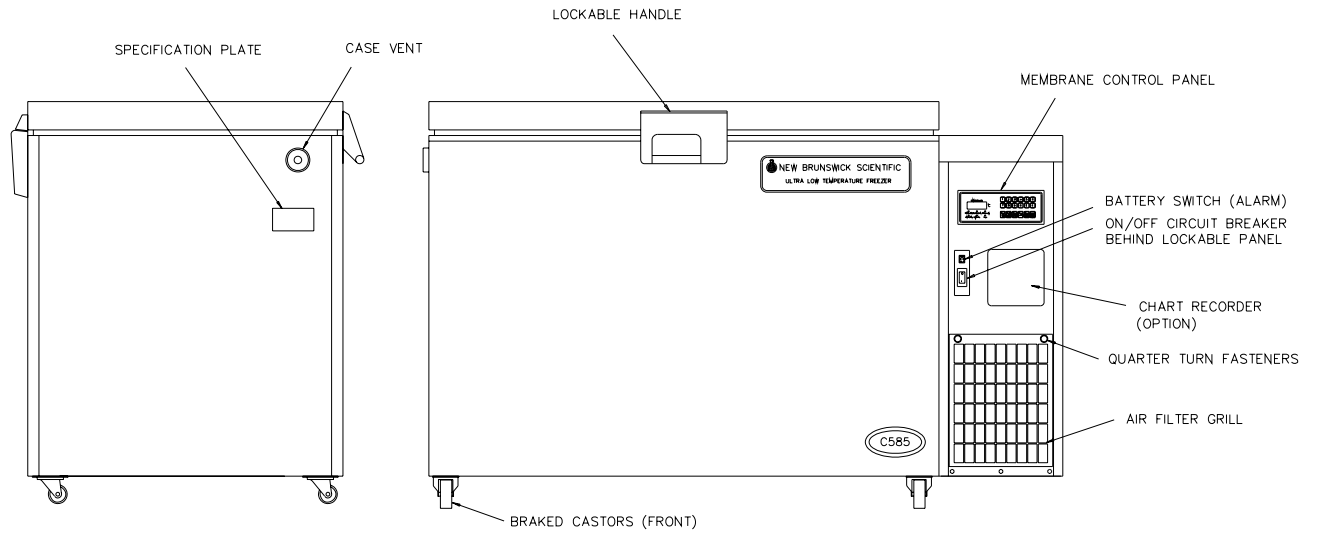
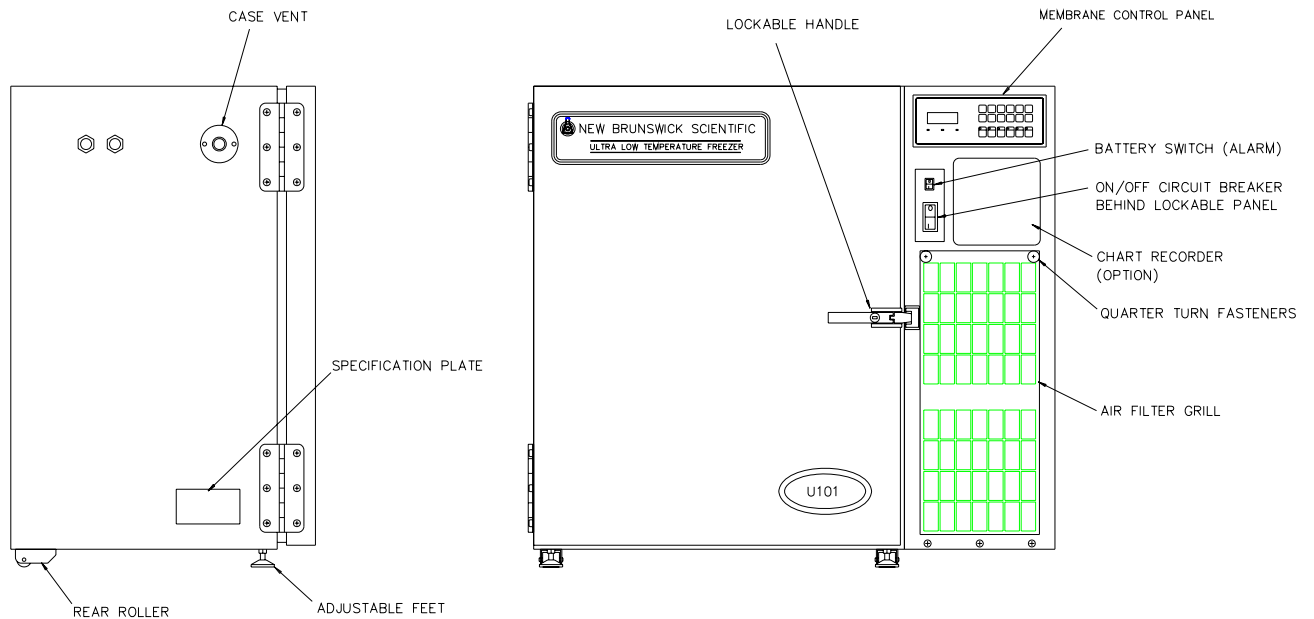


Figure 3: U101 Freezer—Side and Front Views



2.1.1 Freezer Handles

Freezers are supplied with lockable handles.

The U101, C585 and C760 are fitted with quarter turn key locks.

The U535 and U725 upright freezer handles are fitted with barrel locks (push to lock, turn key to unlock). The barrel lock may be removed from the upright freezer handle if the lock facility is not required:

1. Remove the two retaining screws at the rear of the handle.
2. Remove the lock barrel and packing plate.
3. Fit the plastic blanking plug supplied.
4. Refit the packing plate using the existing screws.

 **NOTE:**

It is important that the handle lock packing plate be fitted at all times.

 **NOTE:**

For UPRIGHT freezers: DO NOT SLAM THE DOOR WITH THE HANDLE IN THE CLOSED POSITION.

The door handle has a cam action to pull the door closed and a reverse cam action to break the seal so the door can be opened. When closing the outer door, ensure that the cam is engaged for correct operation. The initial vacuum inside the cabinet may cause the door to appear closed, but when the vacuum releases, the door will open. Always ensure the handle is properly engaged.

2.1.2 Voltage Stabilizer

Certain freezer models are fitted with an automatic voltage stabilizer. See Section 4.7 for details.

3 INSTALLATION



CRUSH WARNING!

DO NOT attempt to lift any freezer by hand. Preferred lifting for loading and unloading is by hydraulic tail lift.

Maintenance, adjustment and repair work should be carried out only by QUALIFIED, EXPERIENCED personnel who have been AUTHORIZED to undertake such work by New Brunswick Scientific or its authorized agents.

Failure to use authorized service agents may invalidate the warranty.

3.1 Physical Location

All freezers are mounted on castors for ease of movement. Upright freezers have feet that provide both a leveling feature and a locking feature to stop the freezer from rolling once it is in place. Chest freezers have locking front castors; these do not provide leveling adjustment, so the site chosen for the freezer must have a flat, level floor.

Position the freezer to allow free air entry through the intake grill and free air exit from the back; provide a clearance of at least 6 inches (150 mm) on all sides. The grill is located on the front of both chest and upright models (*see Figures 1, 2 & 3 above*).

For efficient temperature control, the freezer should be placed in a shaded area, away from sources of excessive heat. For maximum cooling capability, the unit should be located in an air-conditioned room.



WARNING!

BEFORE connecting the freezer to the electrical supply, make sure that the power supply matches the requirements of the equipment. Check the specification plate (located on the side of the freezer) for the electrical requirements.

Model U101 upright freezers are fitted with one fixed shelf. Model U535 and U725 upright freezers are fitted with two adjustable shelves. These can be positioned in ½ inch (12.7 mm) steps anywhere throughout the freezer. To remove the shelf, gently squeeze the shelf clip to release it from the side of the freezer, then reposition it as required.

3.2 **Getting Started**

3.2.1 **Plug In**

Once you have verified that the power supply matches the electrical requirements of the freezer, connect the unit to the power supply using the power cord provided.



CAUTION!

If the freezer's voltage rating does not match your electrical supply, or if the plug on the power cord does not fit the outlet, *do not plug the freezer in.* Contact your laboratory supervisor, safety officer, or qualified service or electrical engineer.



NOTE:

Some freezers are supplied with more than one removable power cord. Utilize the cord that matches your power receptacle. Check the voltage rating plate on the side of the freezer, to confirm that the freezer is compatible with your laboratory power supply.

3.2.2 **Turn On**

The **ON/OFF** circuit breaker is located within the lockable panel (a) at the bottom right-hand corner of the upright freezer, or (b) to the left of the control panel on the chest models. The panel can be removed by turning the key (provided) one quarter turn to the right. The key can be removed to prevent access.

Set the **ON/OFF** circuit breaker to the I (ON) position. The temperature display illuminates immediately.

The following models have a built-in voltage stabilizer for the supply voltage:

- Innova U535, 100-120V and 208-220V, 60 Hz
- Innova U725, 208-220V, 60Hz
- Innova C585, 100-120V and 208-220V, 60Hz
- Innova C760, 208-220V, 60Hz

See section 4.7 for operation.



NOTE:

The freezer's compressor will not operate for approximately one minute after connection of the power supply, because there is an automatic delay device in the circuit. Temperature and alarm settings, however, can be adjusted immediately.

3.2.3 Alarm Activation

The equipment is delivered with the battery deactivated. The Power Fail alarm is activated by the battery rocker switch within the lockable panel. On upright models, the panel is located at the bottom right-hand corner. On chest models, the panel is located on front right of the unit, near the display. The switch is labelled **I (ON)** and **O (OFF)**. (See *Figures 1, 2 & 3.*)

To activate the alarm, put the battery switch in the **I** position.

After activating the alarm, test its operation by pressing the **ALARM TEST/MUTE** key on the display. The audible alarm should sound. The **ALARM TEST/MUTE** key also tests the LED lamps. All of the LEDs should light up together when the button is pressed.



NOTE:

When the equipment is first switched on, it will take approximately six hours to reach a temperature of -86°C. The alarm will sound every 30 minutes until the temperature setpoint is reached. Use the ALARM TEST/MUTE key to mute the alarm during this initial pull-down period.

If the freezer is turned off during the initial pull-down period, the alarm will activate 30 minutes after you switch it back on again.

The factory-set temperature is -80° C.

3.2.4 Remote Alarm

The freezer is also fitted with a remote alarm socket (*see Section 4.4 for details*). This can be tested by turning off (O) the **ON/OFF** circuit breaker. This tests the **POWER FAIL** (*see Section 4.1*) and **ALARM** output at the same time. The battery must be switched on to test the **POWER FAIL**. The remote alarm facility provides voltage-free contacts rated at 1 amp, 24 volts maximum.

3.2.5 Vacuum Effect

After closing the door or lid of the freezer, following access to the contents, a vacuum may be created. Before the door can be opened again, it may be necessary to wait two or three minutes for the vacuum to be released by the vent tube. Do not try to force the door or lid. During the release of the vacuum, a slight hissing may be heard. In order to minimize vacuum formation, the vent heater assembly has a spring-loaded plunger to clear ice from the inside of the vent.



NOTE:

Be careful not to place a rack directly against the vent, as this will inhibit the plunger's ability to operate correctly (*see Section 5.1.4*).

4 OPERATING CONTROLS & DISPLAYS

4.1 *Operating Controls*

Switch the freezer on using the **ON/OFF** circuit breaker at the front of the equipment. On upright models (except U101), this is located behind the lockable panel, low on the right-hand side. On chest and U101 upright models, it is located behind the lockable panel on the right-hand side, adjacent to the control panel. (See Figures 1, 2 & 3)

Operating controls are located on a membrane panel mounted in the door of the upright models U535 and U725. The same panel is located on the right-hand side of all chest freezers and the small U101 upright model.

Every NBS freezer is equipped with the unique S.M.A.R.T. Plus™ diagnostic software, to help identify, by means of an error code, the cause of a fault or setpoint variance.

The available functions, identified by key Item numbers in Figure 4, are described in the sections below.

4.1.1 Temperature °C Display

| <i>Item</i> | <i>Name</i> | <i>Function</i> |
|-------------|-----------------------|---|
| 1 | TEMPERATURE °C | The digital display normally shows the current internal temperature of the freezer. Temperature is displayed in 1°C increments. |

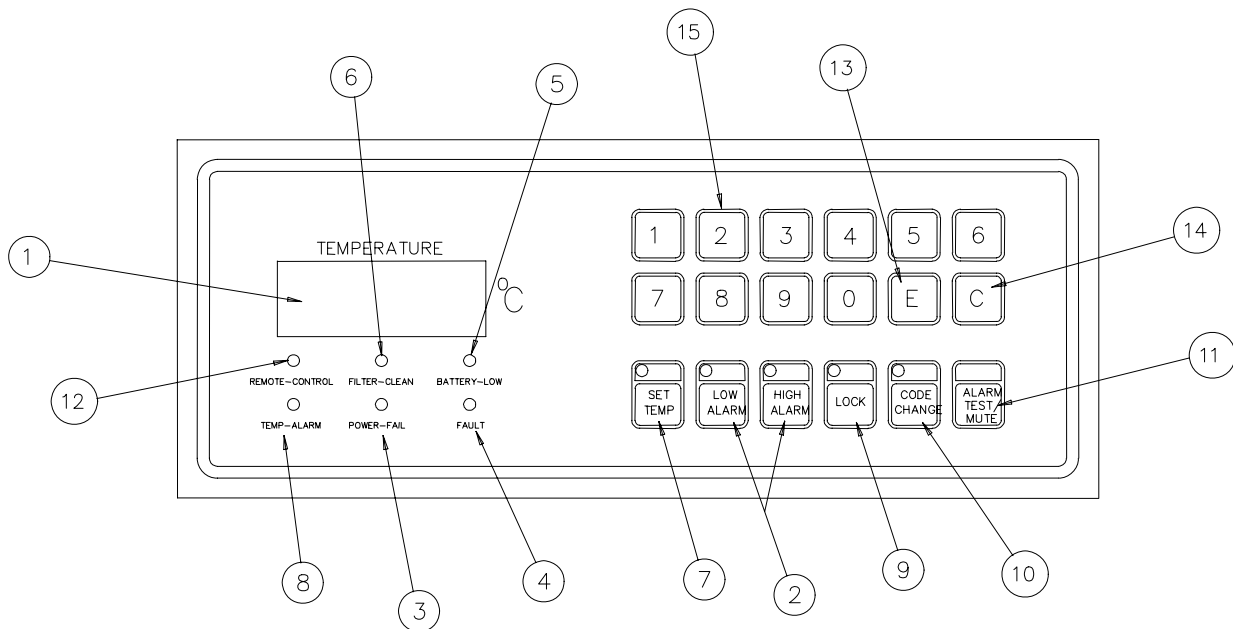
4.1.2 High Alarm/Low Alarm Lights

| <i>Item</i> | <i>Name</i> | <i>Function</i> |
|-------------|------------------------------|---|
| 2 | [HIGH/LOW] TEMP-ALARM | Illuminates if the freezer's internal temperature is above/below the user-selected alarm setpoints. Illuminates as soon as the setpoint is passed. The audible alarm, however, does not sound until the freezer temperature has been beyond alarm setpoint for 30 minutes. After the temperature returns to the normal range, the TEMP-ALARM switches off & the audible warning stops. |

 **NOTE:**

The audible alarm can be turned off by pressing the **ALARM TEST/MUTE KEY**. If, after 30 minutes, the temperature has not returned to normal range, the audible warning will sound again. This pattern will continue to repeat until the temperature returns to normal.

Figure 4: Membrane Keypad



4.1.3 Temp-Alarm Light

| <i>Item</i> | <i>Name</i> | <i>Function</i> |
|-------------|-------------------|---|
| 8 | TEMP-ALARM | Should a power failure cause the temperature to surpass the alarm setpoint, the TEMP-ALARM illuminates. (The audible alarm will already be sounding due to the power failure). The TEMP-ALARM will stay on after the temperature returns to normal range, to indicate that a power failure has occurred. Temperature-sensitive samples stored in the freezer should be checked for deterioration. Cancel the TEMP-ALARM by pressing the ALARM TEST/MUTE KEY . |

4.1.4 Power-Fail Light

| Item | Name | Function |
|-------------|-------------|---|
| 3 | POWER-FAIL | Illuminates if the power supply fails, flashing at approximately 10-second intervals, accompanied by an audible alarm. When power is restored, the indicator goes off and the audible alarm stops. (The battery must be switched on and charged for this indicator to operate.) |

4.1.5 Fault Light

| Item | Name | Function |
|-------------|-------------|--|
| 4 | FAULT | Illuminates if there is a system failure within the freezer. Interfacing with the S.M.A.R.T. Plus™ diagnostics via the control panel, the fault can be determined (<i>see Section 6.1</i>). System failure is accompanied by an audible alarm. Correction of the fault extinguishes the light and audible alarm. |

4.1.6 Battery-Low Light

| Item | Name | Function |
|-------------|-------------|--|
| 5 | BATTERY-LOW | <i>With power ON:</i> illuminates if battery voltage is below 6 volts; starts flashing when voltage drops to 5 volts. <i>With power OFF:</i> should battery voltage drop below 5.5 volts, this fault indicator will stop functioning. |

4.1.7 Filter-Clean Light

| Item | Name | Function |
|-------------|--------------|--|
| 6 | FILTER-CLEAN | Illuminates, accompanied by an audible alarm, to indicate a potentially blocked or dirty filter. Filter is located on the front at the bottom of all freezers. Remove by turning the two thumbscrews on the filter holder ¼ turn. Clean filter by washing in mildly soapy water, then air dry. If filter warning light does not go out after replacing the cleaned filter, contact your local New Brunswick Scientific service representative. |

4.1.8 Remote Control Light

| <i>Item</i> | <i>Name</i> | <i>Function</i> |
|-------------|-----------------------|---|
| 12 | REMOTE CONTROL | Indicates when freezer is operating under remote computer control via the optional RS-485 interface port. |

4.1.9 Set Temp Key

Operation in normal mode with **LOCK** lamp off.

| <i>Item</i> | <i>Name</i> | <i>Function</i> |
|-------------|-----------------|--|
| 7 | SET TEMP | Displays current temperature setting. Used to change temperature settings. |

4.1.10 High Alarm/Low Alarm Keys

Operation in normal mode with **LOCK** lamp off.

| <i>Item</i> | <i>Name</i> | <i>Function</i> |
|-------------|-------------------|--|
| 2 | HIGH-ALARM | Displays current high alarm temperature setting. |
| 2 | LOW ALARM | Displays current low alarm temperature setting. |

4.1.11 Lock Key

Normal mode is with **LOCK** lamp off.

| <i>Item</i> | <i>Name</i> | <i>Function</i> |
|-------------|-------------|---|
| 9 | LOCK | Locks and unlocks the control panel for programming sequence. |

4.1.12 Code Change Key

Operation in normal mode with **LOCK** lamp off.

| <i>Item</i> | <i>Name</i> | <i>Function</i> |
|-------------|--------------------|--|
| 10 | CODE CHANGE | Used to change freezer lock codes. Inactive in normal mode. |

4.1.13 Alarm Test/Mute Key

Operation in normal mode with **LOCK** lamp off.

| <i>Item</i> | <i>Name</i> | <i>Function</i> |
|-------------|------------------------|---|
| 11 | ALARM TEST/MUTE | Sounds the audible alarm. If the audible alarm is on due to a fault condition, press this key to silence the alarm. The lamp LED lights can also be tested by pressing this key. The lights should all illuminate and the display should read “8888”. |

4.1.14 “E” Key

Operation in normal mode with **LOCK** lamp off.

| <i>Item</i> | <i>Name</i> | <i>Function</i> |
|-------------|-------------|--------------------------------------|
| 13 | E | Used to enter data when programming. |

4.1.15 “C” Key

Operation in normal mode with **LOCK** lamp off.

| <i>Item</i> | <i>Name</i> | <i>Function</i> |
|-------------|-------------|---------------------------------------|
| 14 | C | Used to cancel data when programming. |

4.1.16 Numerical Keys

Operation in normal mode with **LOCK** lamp off.

| <i>Item</i> | <i>Name</i> | <i>Function</i> |
|-------------|-----------------------------|--------------------------------------|
| 15 | NUMERICAL KEYS (1-0) | Used to input data when programming. |

4.2 Programming the Freezer

Set the freezer to any temperature within the optimal range from -50°C to -86°C.

4.2.1 Setting Operating Temperature

To set the operating temperature for the freezer:

1. Press the **LOCK** key. The **LOCK** lamp will go on, indicating the system is unlocked and parameters can be changed.
2. Press the **SET TEMP** key; its indicator will flash and the display will indicate 0.
3. Using the numerical keys, enter a new temperature. The temperature selected will appear in the **TEMPERATURE** display.
4. If you make any input errors, use the **C** key to clear the display.
5. When the correct temperature is displayed, press the **E** key to enter the data. The **SET TEMP** lamp will go off.



NOTE:

All temperature setpoints are automatically negative °C.

4.2.2 Setting High/Low Alarm Setpoints

After you have set the operating temperature, and while the **LOCK** is still unlocked, select the **high setpoint** beyond which the temperature should not rise:

1. Press the **HIGH ALARM** key; its indicator will flash and the display will indicate 0.
2. Using the numerical keys, enter a new alarm setpoint temperature. The selected temperature will appear in the **TEMPERATURE** display.
3. If you make any input errors, use the **C** key to clear the display, then enter the correct value.
4. When the correct temperature is displayed, press the **E** (Enter) key to enter the data. The **HIGH ALARM** indicator will turn off.

Now select the **low setpoint** below which the temperature should not drop:

5. Press the **LOW ALARM** key; its indicator will flash and the display will indicate 0.
6. Using the numerical keys, enter a new alarm setpoint temperature. The selected temperature will appear in the **TEMPERATURE** display.
7. If you make any input errors, use the **C** key to clear the display, then enter the correct value.
8. When the correct temperature is displayed, press the **E** (Enter) key to enter the data. The **LOW ALARM** indicator will turn off.

9. With the operating temperature and high & low alarm temperatures set, press the **LOCK** key again. The **LOCK** lamp will go out and the freezer will return to normal mode.

When you press the **LOCK** key, if its light flashes, a lock code (*see Section 4.2.4 below*) has been entered. This is a security code, which means that the temperature settings cannot be changed if you do not know the lock code.

4.2.3 Checking Temperature Settings

To find out what operating temperature has been set for the freezer, press the **SET TEMP** key and read the display.

To find out what alarm setpoint has been set, press the **HIGH ALARM** key or the **LOW ALARM** key and read the display.

If you press the **SET TEMP**, **HIGH ALARM** or **LOW ALARM** key while the **LOCK** key lamp is flashing, the display will read ----, which indicates that the freezer is locked.

4.2.4 Changing Lock Codes



CAUTION!

If you enter a lock code when there is none, or if you replace an existing lock code with a new one, be sure to take careful note of the new code before you enter it.

If the code is forgotten, you will need to contact Customer Service to regain access to the programming mode of the freezer.

The freezer is delivered unlocked. To change the code, the freezer must be unlocked. If a lock code has already been set (indicated by the **LOCK** lamp flashing when the **LOCK** key is pressed), that same code must be entered to unlock the freezer. When the freezer is unlocked, the **LOCK** lamp is on (not flashing).

Once the freezer is unlocked, follow these steps to set a new lock code:

1. Press the **CODE CHANGE** key. The lamp will flash and the display will go blank.
2. Using the numerical keys, enter the new four-digit number. Check it on the display.

3. Press the **C** key to cancel the entry if the display shows it to be incorrect, then enter the correct number.
4. When the number is correct, record the new number somewhere secure (where it will not be lost but where it will not be accessible to anyone unauthorized), then press the **E** (Enter) key. The **CODE CHANGE** indicator will turn off.
5. Press the **LOCK** key; its indicator will turn off.

The freezer now has a new lock code. If at any time you wish to change this code, as indicated above, you will have to enter this code to unlock the system before you can enter a new code.

Setting the lock code to 0000 disables the lock completely. With the 0000 code, you would need only press the **LOCK** key to reprogram the freezer.

4.3 Battery Backup Switch

This is a rocker switch labeled **I/O** behind the locked front panel. In the **O** position, the battery is disconnected. This position should only be used while in transit, in storage, or to change the battery.

At all other times the switch should be kept in the **I** position for the battery to be charged, and for the alarm function to be available in the event of power failure. **(Failure to set the switch may result in impaired battery life, and the alarm will not trigger if the power fails.)**

With the battery switch on, during a power failure, the internal freezer temperature will be displayed at ten-second intervals, and the audio alarm will also sound. The audible alarm may be muted by pressing the **ALARM TEST/MUTE** key on the control panel, but will sound again after 30 minutes if the fault has not been corrected. Pressing the same button again will mute the alarm for an additional 30 minutes; the pattern will continue to repeat until the initial problem is corrected.

4.4 Alarm Monitoring Socket

The freezers are provided with an alarm monitoring socket at the rear of the freezer and a matching plug for external monitoring purposes. This plug can be connected either to a central monitoring system or to a remote alarm via an auto-dialer. The configuration of the socket is shown in Figures 5 & 6, as viewed from the rear of the freezer.

Within the freezer, the socket is connected to voltage-free contacts rated at 24 volts, 1 amp. In normal operation, with the power on, pin 1 is connected to pin 2 (N/C), and in the alarm condition, with power off, pin 1 is connected to pin 3.

**CAUTION!**

Hazardous voltages must not be connected to the remote alarm socket.
Maximum rating is 24 volts, 1 amp.

Figure 5: Remote Alarm Socket—Chest & U101 Upright Freezers

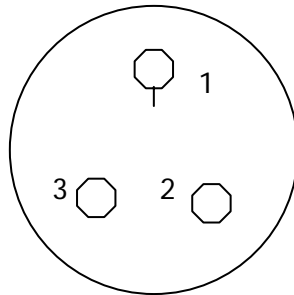
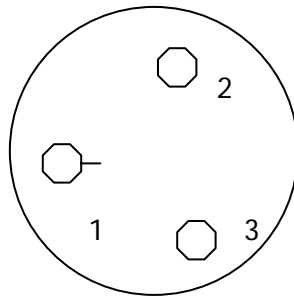


Figure 6: Remote Alarm Socket—Upright Freezers (except U101)



4.5 *Removal & Reinstallation*

Should it be necessary to relocate the freezer at any time, care should be taken when moving it.

DO NOT tilt the freezer, and avoid giving the freezer any bumps or shocks as this can displace the hermetically sealed compressors from their suspension system.

**CRUSH WARNING!**

These freezers are very heavy. **DO NOT** attempt to lift any freezer by hand. Always have a trained operator use mechanical lifting equipment.

4.6 General Operating Procedures



WARNING!

Be sure to wear protective gloves at all times when handling glassware and/or ultra-low temperature items.

4.6.1 After a Power Failure

Should the power supply be interrupted for any reason, the **POWER-FAIL** indicator lamp (Item ③ in Figure 4) will illuminate. In addition, the audible alarm will sound and the display will flash at approximately 10-second intervals.

When power is restored, both alarm and light will automatically be cancelled.

If power has been interrupted for only a short time, the internal temperature of the freezer will not have risen above the temperature setpoint (the user-set alarm threshold), so normal operation will be resumed immediately.

If, however, the interruption was long enough for the internal temperature to rise above the temperature setpoint, the **TEMP-ALARM** indicator will illuminate. If the internal temperature does not fall below the temperature setpoint within 30 minutes after power was restored, the audible alarm will sound again. The **TEMP-ALARM** indicator will remain illuminated until the operator resets it by pressing the **ALARM TEST/MUTE** key.

4.6.2 Interior Warming

If the lid or door is left open long enough for the internal temperature to rise above the temperature setpoint, the same effects will be observed as described in Section 4.6.1 above regarding power failure.

To minimize the risk of this happening, the lid or door should not be opened more frequently than is absolutely necessary, and then only for the shortest possible time.

The upright freezers are fitted with internal doors which latch shut, minimizing temperature rise when the outer door is opened. Inner door gaskets require the door to be latched at all times when the freezer is running.

Chest freezers are fitted with inner insulating lids to ensure efficient running of the freezer. These should remain fitted at all times when the freezer is running.

4.7 Voltage Stabilizer

The following freezer models have a built-in voltage stabilizer:

- Innova U535, 100-120V and 208-220V, 60 Hz
- Innova U725, 208-220V, 60Hz
- Innova C585, 100-120V and 208-220V, 60Hz
- Innova C760, 208-220V, 60Hz

The built-in voltage stabilizer automatically compensates for variations in the supply voltage (in case of over-voltage, brown-outs, dips, sags and surges). The output is only switched if the power disturbance is sustained for at least two seconds.

4.7.1 Voltage Stabilizer Operation

The voltage stabilizer unit indication is displayed on the lower right front panel of the upright freezers and on the front panel above the air filter on the chest freezers.

When you switch the freezer on, if the input voltage is within the specified range, the green LED **NORMAL** will illuminate. If the voltage stays within the specified range, the green LED will remain illuminated.

Sustained variations in the input power will be automatically compensated for by the stabilizer circuit and indicated by a red LED for **HIGH** voltage or an amber LED for **LOW** voltage.

4.7.2 Voltage Stabilizer Specifications

| | 208V Unit | 115V Unit |
|--|-------------------------|------------------------|
| Rated at | 15 Amps | 20 Amps |
| Line Voltage : | | |
| ▪ Normal Freezer Operating Voltage | 230V \pm 10% | 115V \pm 10% |
| ▪ Normal Voltage Stabilizer Operating Range (LED Green) | 204V-242V \pm 2.5V | 106-123V \pm 2.5V |
| ▪ Low (Boost) Voltage Limit (LED Amber) | <204V | <106V |
| ▪ High (Buck) Voltage Limit (LED Red) | >242V | >123V |

4.7.3 Start-Up

To start the freezer, connect the power cord and switch on the main circuit breaker. Set the battery switch (*see Figures 1-3*) to I (ON). After approximately one minute, the compressors will start to cool the freezer.

5 MAINTENANCE



CAUTION!

Maintenance, adjustment and repair work should be carried out only by qualified & experienced personnel who have been authorized to undertake such work by New Brunswick Scientific or its authorized agents.

5.1 Cleaning

5.1.1 Painted Surfaces

All exterior paint work and inner doors should be cleaned using a solution of mild detergent in water. **Do not use abrasive cleaners or solvents.**

5.1.2 Panels & Shelves

The interior panels and shelves are made of stainless steel. They may be cleaned and sterilized.

5.1.3 Air Intake Grill & Filter

The air intake grill must be cleaned regularly to keep it free from dust and debris. Under normal conditions, clean the grill once every three months. If the area around the freezer is very dusty or dirty, however, clean the grill more often. Brush the grill with a soft brush and, if a vacuum cleaner is available, vacuum the dust from the grill.



CAUTION!

Serious damage to the freezer may result if the air intake is allowed to become blocked. Check that there is no obstruction of the airflow to the freezer. The air intake filter must also be cleaned regularly.

Remove the filter from behind the grill by turning the thumbscrews $\frac{1}{4}$ turn and opening grill downward. The filter should be washed in warm soapy water and left to air dry before replacing.

5.1.4 Vent Tube

 **NOTE:**

There is an electrically-heated vent tube in the freezer which must not be allowed to become blocked or sealed off.

Over a period of a few weeks, depending on how often the freezer is being used, a small mushroom of ice will form around the end of the vent tube. If the vent tube is allowed to become blocked, a vacuum will be created when the door is closed. It will not then be possible to open the door or lift the lid until the vacuum has leaked away through the seal, which can take up to two hours due to the high quality of the seals.

The vent tube is located (a) on the top left-hand side of upright models and (b) on the left-hand side of chest models. If the door or lid cannot be opened, press the manual plunger on the outside of the air vent in order to break the ice formation.

5.1.5 Door/Lid Seal

Be sure to treat the door seal on the upright freezer and the lid seal on the chest freezer with great care. Avoid damaging this seal in any way, as the freezer cannot operate properly with a defective seal.

Once each month, it is advisable to wipe both the seal and the surface against which it seals with a soft dry cloth.

5.1.6 Lubrication

Every 12 months the outer door hinges and the handle mechanism should be lightly lubricated using general-purpose oil or spray grease.

5.2 *Defrosting*

After an extended period of operation, defrosting may become necessary:

1. De-activate the alarm by switching the battery (alarm) switch (located behind the lockable panel on the front of the freezer) to **O**.
2. Unplug the freezer from the electrical supply.
3. Leave the door or lid open.
4. Allow the accumulated ice to melt.

**CAUTION!**

**Do not attempt to chip or scrape the ice with a sharp instrument.
Allow the ice to melt naturally.**

5. Mop up the resulting water
6. Dry and decontaminate the interior of the freezer.
7. When defrosting is complete, reconnect the freezer to the electrical supply.
8. Turn the power switch on (I) and re-activate the battery (alarm) switch.

5.3 Electrical Components

5.3.1 Lamps

Regularly check the indicator lamps by pressing the **ALARM TEST/MUTE** key. All of the indicator lamps should illuminate, and the display should read **8888**.

5.3.2 Alarms

Regularly check the alarm by pressing the **ALARM TEST/MUTE** key. The **TEMP** indicator should illuminate and the audible alarm should sound.

**CAUTION!**

There are no user controls behind any panels. The removal of any other part or panels from the freezer by anyone other than a qualified, authorized Service Engineer may invalidate the warranty.

5.3.3 Battery Replacement

The YUASA–NP6V 2.8Ah battery is mounted on the electrical panel. This is located (a) behind the right-hand base cover on the upright freezers, or (b) in the compressor housing on the chest freezers.

**WARNING!**

Use only a replacement battery of the correct type and part number.

The battery must be fitted so the terminals correspond to the polarity labels on the electrical panel.

To replace the battery, first switch off the power switch and disconnect the power supply. Remove the side cover and the battery clamp securing the battery to the electrical panel. Disconnect the battery terminals.

Be certain, when reconnecting the battery, to respect the correct polarity (red is + positive and black is – negative).

5.3.4 Fuses

The following are the specifications for the fuses required by the freezers:

| | |
|-------------------------------------|--|
| Main Power Supply Plug (UK only) | 13A Bussmann 1 x ¼" |
| †Control Panel | FS1 - 800mA 20x5mm Quick Acting (F) 250V Ceramic FS2 - 1A 20x5mm Anti-Surge (T) 250V Ceramic FS3 – 1A 20x5mm Anti-Surge (T) 250V Ceramic |
| †PCB A1201 | FS1 - 2A 20x5mm Quick Acting (F) 250V Glass |
| †Voltage Stabilizer | FS4 – 1A 20x5mm Anti-surge (T) 250V Ceramic |

† These fuses must be replaced by an NBS-approved service engineer.

6 TROUBLESHOOTING

If you are experiencing a problem with your freezer, check the following troubleshooting guides before you contact your NBS authorized Service technician.

6.1 Error Codes

Your electronically-controlled NBS freezer incorporates the unique Systems Monitoring And Reporting Technology (S.M.A.R.T. Plus™) self-diagnostic software to diagnose faults in its electronic systems, its probes and/or its refrigeration system.

This table interprets error codes that may appear in the control panel display:

| Error Code | Possible Solution/Explanation |
|-------------------|---|
| E-01 | PT100 Probe 1 failure. This probe, located inside the freezer cabinet, indicates cabinet temperature. Call NBS Service department. |
| E-02 | Probe 2 failure. This probe monitors the cascade condenser. Call NBS Service department. |
| E-03 | Probe 3 failure. This probe monitors the air-cooled condenser. Call NBS Service department. |
| E-04 | Air-cooled condenser temperature too high: (1) Filter may be blocked. Clean filter according to the instructions in Section 5.1.3. (2) Ambient temperature may be too high. Cool the room. <i>If alarm continues,</i> (3) Fan may have failed. Call NBS Service department. |

6.2 Other Symptoms

| Symptom | Possible Solution/Explanation |
|------------------------------|---|
| Door won't open | (1) Check to see if handle is locked; unlock with key. (2) Use manual plunger in air vent to break ice (<i>see Section 5.1.4</i>). <i>If door still won't open,</i> (3) Call NBS Service department. |
| FILTER-CLEAN light on | (1) Clean the filter according to the instructions in Section 5.1.3. <i>If the light remains on,</i> (2) Call your NBS service department. |

...continued...

| <i>Symptom</i> | <i>Possible Solution/Explanation</i> |
|---|---|
| Two or three Voltage Stabilizer LEDs are on at once | Voltage Stabilizer may have failed. Call NBS Service department. |
| No Voltage Stabilizer LED is on | Voltage Stabilizer may have failed. Call NBS Service department. |

7 ACCESSORIES & SPARE PARTS

7.1 **Accessories**

A number of accessories are available for the New Brunswick Scientific range of ultra-low temperature freezers. Contact your local NBS representative or distributor for details.

7.1.1 **CO₂ & LN₂ Back-Up Systems**

These systems are available to temporarily protect the contents of the freezer against the consequences of freezer or power failure. In an emergency, the system can inject either carbon dioxide or liquid nitrogen from a storage bottle. Carbon dioxide back-up systems will maintain temperatures between -40°C and -70°C (subject to environmental conditions) for a period of up to 48 hours, during which time the freezer can be repaired. Liquid nitrogen back-up systems will maintain the freezer temperature at -86°C.

CO₂ and LN₂ back up systems can be retrofitted by the user. Contact your local NBS distributor for options available. Instructions are included in the kit.

7.1.2 **Racking Systems**

A very comprehensive set of aluminum racks is available. These are designed to accommodate various sizes of boxes neatly, while giving maximum packing density in the freezer. Custom-made racking may also be available upon request.

7.1.3 **Chart Recorder**

A chart recorder is available to provide a continuous record of the temperature inside the freezer over a period of seven days. The record is presented on a circular chart.

The following items are available for all freezer models:

| <i>Description</i> | <i>Quantity</i> | <i>Part Number</i> |
|---------------------------|------------------------|---------------------------|
| Chart Recorder Kit | 1 | K0440-0355 |
| Chart Recorder Paper | 100 | K0540-0025 |
| Chart Recorder Pens | 3 | K0660-0051 |

7.1.4 RTMS Software/RS-485 Computer Interface

This allows up to 30 individual freezers to be remotely temperature-controlled and monitored. The computer interface comes complete with datalogging and control software.

7.2 Spare Parts



NOTE:

Only NBS-approved engineers may service these Ultra-Low Temperature Freezers.

| Description | Part Number | Freezer Model(s) |
|---|--------------------|-----------------------------|
| Battery 6V, 2.8 Ah | K0480-0170 | All |
| Fuse 1A ceramic, pack of 5 | K0380-0565 | All |
| Fuse 800mA, pack of 5 | K0380-0560 | All |
| Fuse 2A T 250v (Control PCB), pack of 5 | P0625-1240 | All |
| Fuse 1x1/4" 13A (UK only), pack of 5 | K0380-0570 | All (UK only) |
| Key Only for Power Switch Locking Plate | P0625-0111 | All |
| Key Only for Black Plastic Door Handle | P0625-0640 | Upright models |
| Key & Lock for Black Plastic Door Handle | P0625-0113 | Upright models |
| Key Only, Chest Lid Handle | P0625-0110 | Chest models |
| Key Only, U101 Door Handle | K0160-1500 | U101 |
| Power Switch Plate Lock | K0160-0082 | All |
| Power Switch Locking Plate (light grey) | K0160-0085 | U101 |
| Power Switch Locking Plate (charcoal) | P0625-0170 | All except U101 |
| Power Cord, 230V 50 Hz UK | P0625-0357 | All |
| Power Cord, 230V 50 Hz, European Schuko | P0625-0356 | All |
| Power Cord, 115V 60 Hz | P0625-0355 | U101 |
| Power Cord, 115V 60 Hz | P0625-0354 | All except U101 |
| Power Cord, 208/220V 60 Hz | P0625-0358 | All |
| Black Draw Latch Handle, U101 | K0220-0428 | U101 |
| Key & Lock for Chest Handle | K0220-0425 | Chest models |
| Chest Handle Replacement Kit | K0160-0135 | Chest models |
| Black Plastic Molded Handle Replacement Kit | K0220-0431 | Upright models, except U101 |

...continued...

| Description | Part Number | Freezer Model(s) |
|---|--------------------|-----------------------------|
| Black Plastic Molded Handle (handle only) | K0220-0432 | Upright models, except U101 |
| Outer Door Latch Assembly (replacement) | K0160-0067 | Uprights, except U101 |
| Air Filter, U101 (replacement) | K0200-0506 | U101 |
| Air Filter, Uprights (replacement) | K0200-0511 | Upright models |
| Air Filter, Chest (replacement) | K0200-0516 | Chest models |
| Air Filter Grill, U101 | K0200-0505 | U101 |
| Air Filter Grill, Uprights | K0200-0510 | Upright models |
| Air Filter Grill, Chest | K0200-0515 | Chest models |
| Inner Lid, C585 | K0160-0777 | C585 |
| Inner Lid, C760 | K0160-0776 | C760 |
| Inner Shelf, U101 | P0625-0180 | U101 |
| Inner Shelf, U535, with mounting clips x 4 | K0280-1034 | U535 |
| Inner Shelf, U725, with mounting clips x 4 | K0280-1036 | U725 |
| Shelf Clips, stainless steel, pack of 4 | K0280-0550 | Upright models |
| Inner Door Assembly, U101 (ABS) | P0625-1310 | U101 |
| Inner Door Assembly, U535 (ABS) | TBA | U535 |
| Inner Door Assembly, U725 (ABS) | P0625-1250 | U725 |
| Hole Plug, Upright Door Handle, 28.5mm, pack of 2 | P0625-0150 | Upright models |
| Hole Plug, Upright Door Handle Lock, 19mm, pack of 2 | P0625-0151 | Upright models |
| Alarm Connector Plug | K0380-0451 | All |
| Black Plastic Bung, CO ₂ /LN ₂ Ports, pack of 2 | K0740-0330 | All |
| Adjustable Front Foot, U101 (stackable models only) | P0625-0130 | U101 |
| Rear Roller Replacement Kit, U101 | K0160-0992 | U101 |
| Adjustable Foot, Uprights | K0160-0995 | Upright models |
| Swivel Castor | K0160-0735 | All |
| Swivel Castor with Brake | K0160-0737 | Chest Models |

For information on availability of spare parts, please call your local NBS equipment supplier.

8 SPECIFICATIONS

8.1 Upright Freezers

| Model No. | U101 | U535 | U725 |
|--|---|---|--|
| Part No. | U9420-000X* | U9430-000X* | U9440-000X* |
| Internal Dimensions: Height x Width x Depth | 640 x 480 x 330 mm 25.2 x 18.9 x 13 in. | 1365 x 640 x 615 mm 53.7 x 25.2 x 24.2 in. | 1365 x 865 x 615 mm 53.7 x 34.0 x 24.2 in. |
| External Dimensions: Height x Width x Depth | 830 x 900 x 566 mm 32.7 x 35.4 x 22.3 in. | 1950 x 800 x 867 mm 76.8 x 31.5 x 34.1 in. | 1950 x 1025 x 867 mm 76.8 x 40.4 x 34.1 in. |
| Capacity | 101 Liters 3.6 cubic feet | 535 Liters 18.9 cubic feet | 725 Liters 25.6 cubic feet |
| Net Weight | 116 Kg 256 lb | 250 Kg 551 lb | 315 Kg 694 lb |
| Lock | Standard | Standard | Standard |
| No. Compartments | 2 | 3 | 3 |
| Interior | Stainless steel grade 304L | | |
| Alarms | Hi/Low temperature, power fail, battery low, filter clean, fault, | | |
| Insulation Material | Vacuum insulation panels and urethane foam | | |
| Remote alarm port | Standard | Standard | Standard |
| RS-485 interface | Optional | Optional | Optional |
| ‡Power Consumption: | | | |
| • 115V elec. supply | 530 Watts | 550 Watts | N/A |
| • 220V elec. supply | N/A | 550 Watts | 685 Watts |
| • 240V elec. supply | 530 Watts | 650 Watts | 660 Watts |
| Power Source (USA) | 100-120V 60Hz single phase | | N/A |
| Power Source (USA) | N/A | 208-220V 60 Hz single phase | |
| Power Source (EU) | 220-240V 50Hz single phase | | |
| Current Rating (USA) | 115V 13 amps | 115V 16.5 amps | N/A |
| Current Rating (USA) | N/A | 220V 9 amps | 220V 10 amps |
| Current Rating (EU) | 230V 5 amps | 230V 5 amps | 230V 6.5 amps |
| Pull Down Time: From +25°C to -85°C (freezer empty; 240V, 50Hz electrical supply**) | | | |
| | 3.7 hours | 4.5 hours | 4.9 hours |
| Performance | -50°C to -86°C (+2°/-1°C) and -20°C to -50°C (≤ ±8°C) at +32°C maximum ambient operating temperature | | |
| Operational Parameters | All freezers use components tested to CE/UL specifications listed below: <ul style="list-style-type: none"> • Indoor use • Altitude up to 2000m • Ambient temperature range 5°C to 40°C • Maximum relative humidity 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C • Power supply voltage fluctuations not to exceed ± 10% of the nominal voltage • Installation category II • Pollution degree 2 | | |

* X = 0 for 100-120V, 2 for 208-220V (N/A for U101) or 1 for 220-240V

**120V & 220V: TBA

‡ Freezer set to -80°C, ambient 20-25°C at rated electrical supply

8.2 Chest Freezers

| Model No. | C585 | C760 |
|--|--|--|
| Part No. | U9400-0000, -0002, -0001 | U9410-0002, -0001 |
| Type | Chest | Chest |
| Internal Dimensions: Height x Width x Depth | 780 x 1200 x 625 mm 30.7 x 47.2 x 24.6 inches | 780 x 1560 x 625 mm 30.7 x 61.4 x 24.6 inches |
| External Dimensions: Height x Width x Depth | 1092 x 1690 x 785 mm 43 x 66.5 x 30.9 inches | 1092 x 2050 x 785 mm 43 x 80.7 x 30.9 inches |
| Capacity | 585 Liters 20.7 cubic feet | 760 Liters 26.9 cubic feet |
| Net Weight | 240 Kg 529 lb | 285 Kg 628 lb |
| Lock | Standard | Standard |
| No. Compartments | N/A | N/A |
| Interior | Stainless steel grade 304L | |
| Alarms | Hi/Low temperature, power fail, battery low, filter clean, fault. | |
| Insulation Material | Vacuum insulation panels and urethane foam | |
| Remote alarm port | Standard | Standard |
| RS-485 interface | Optional | Optional |
| ‡Power Consumption: | | |
| • 115V electrical supply | 580 Watts | N/A |
| • 220V electrical supply | 580 Watts | 698 Watts |
| • 240V electrical supply | 565 Watts | 665 Watts |
| Power Source (USA) | 100-120V 60Hz single phase | N/A |
| Power Source (USA) | 208-220V 60Hz single phase | |
| Power Source (EU) | 220-240V 50Hz single phase | |
| Current Rating (USA) | 115V 16.5 amps | N/A |
| Current Rating (USA) | 220V 9 amps | 220V 10 amps |
| Current Rating (EU) | 230V 5.5 amps | 230V 6 amps |
| Pull Down Time: from +25°C to -85°C (freezer empty; 240V 50Hz electrical supply*) | | |
| | 3.5 hours | 5.5 hours |
| Performance | -50°C to -86°C (+2°/-1°C) and -20°C to -50°C (≤ ±8°C) at +32°C maximum ambient operating temperature | |
| Operational Parameters | <p>All freezers use components tested to CE/UL specifications listed below:</p> <ul style="list-style-type: none"> • Indoor use • Altitude up to 2000m • Ambient temperature range 5°C to 40°C • Maximum relative humidity 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C • Power supply voltage fluctuations not to exceed ± 10% of the nominal voltage • Installation category II • Pollution degree 2 | |

*120V & 220V: TBA

‡ Freezer set to -80°C, ambient 20-25°C at rated electrical supply

9 DRAWINGS

9.1 Circuit Diagram/Wiring Schematic

Figure 7: Circuit Diagram/Schematic for U535, U725, C585 & C760 Models (115/220V, 60 Hz; C760 not available in 115V)

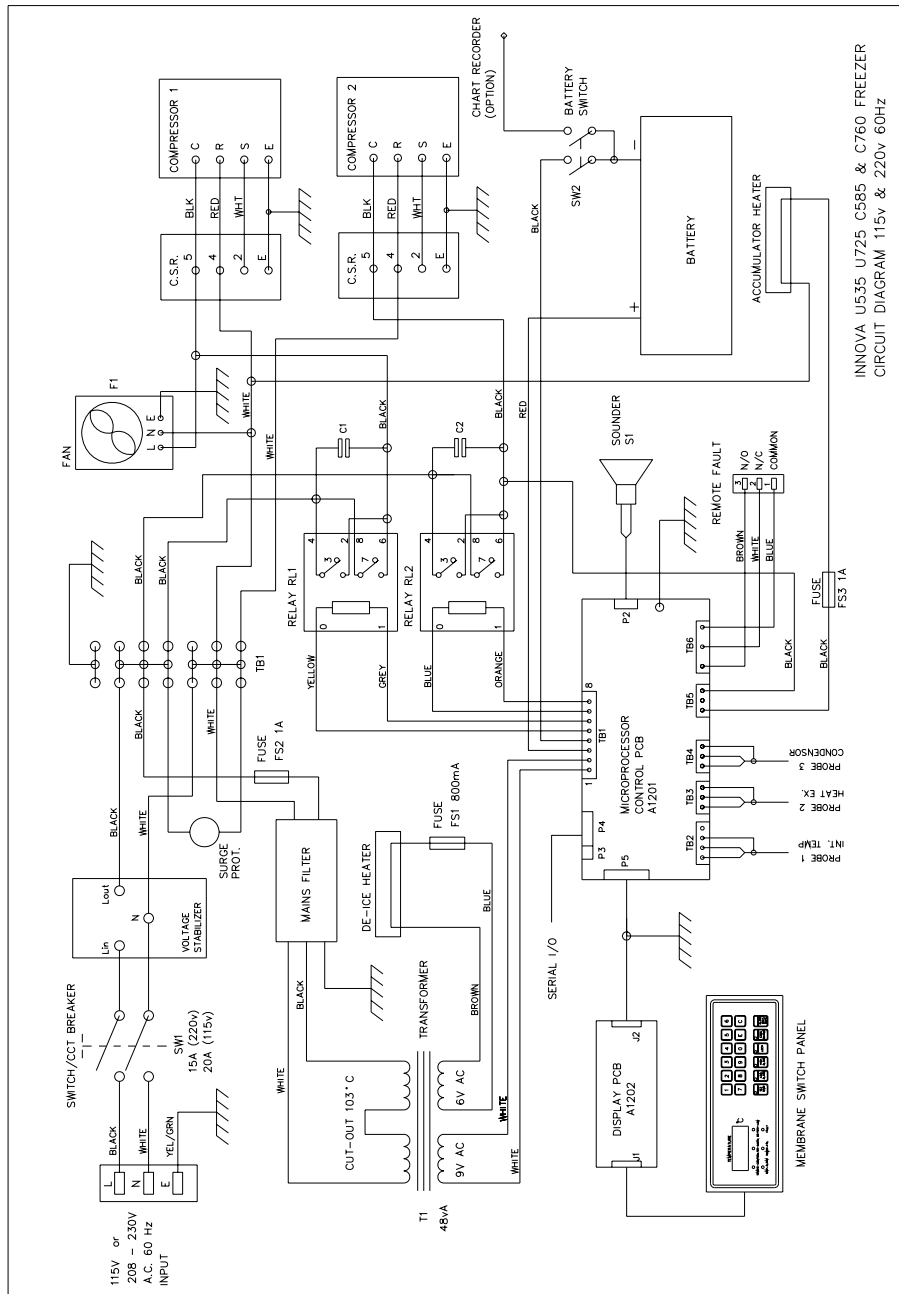


Figure 8: Circuit Diagram/Schematic for U535, U725, C585 & C760 Models (230V, 50Hz)

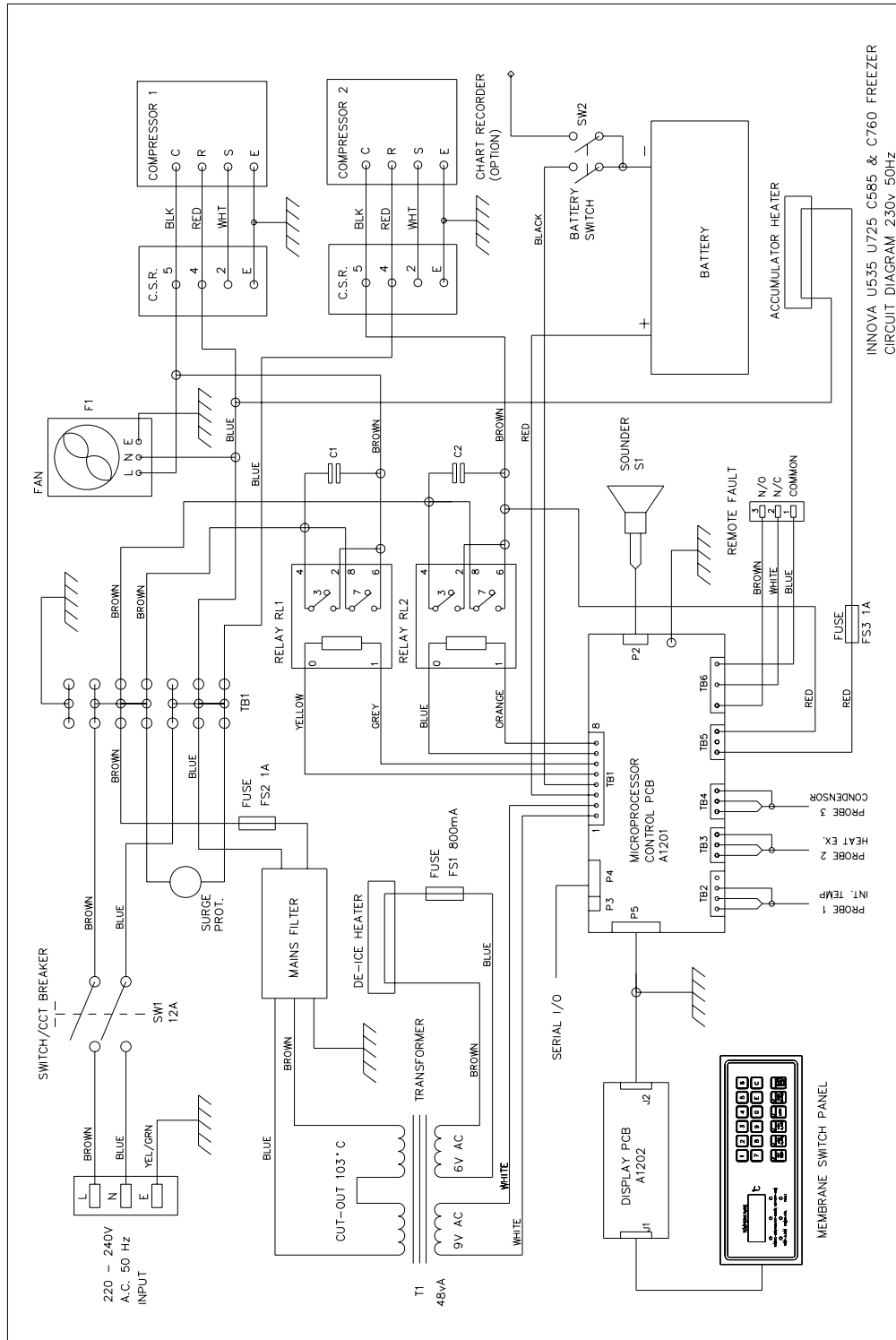
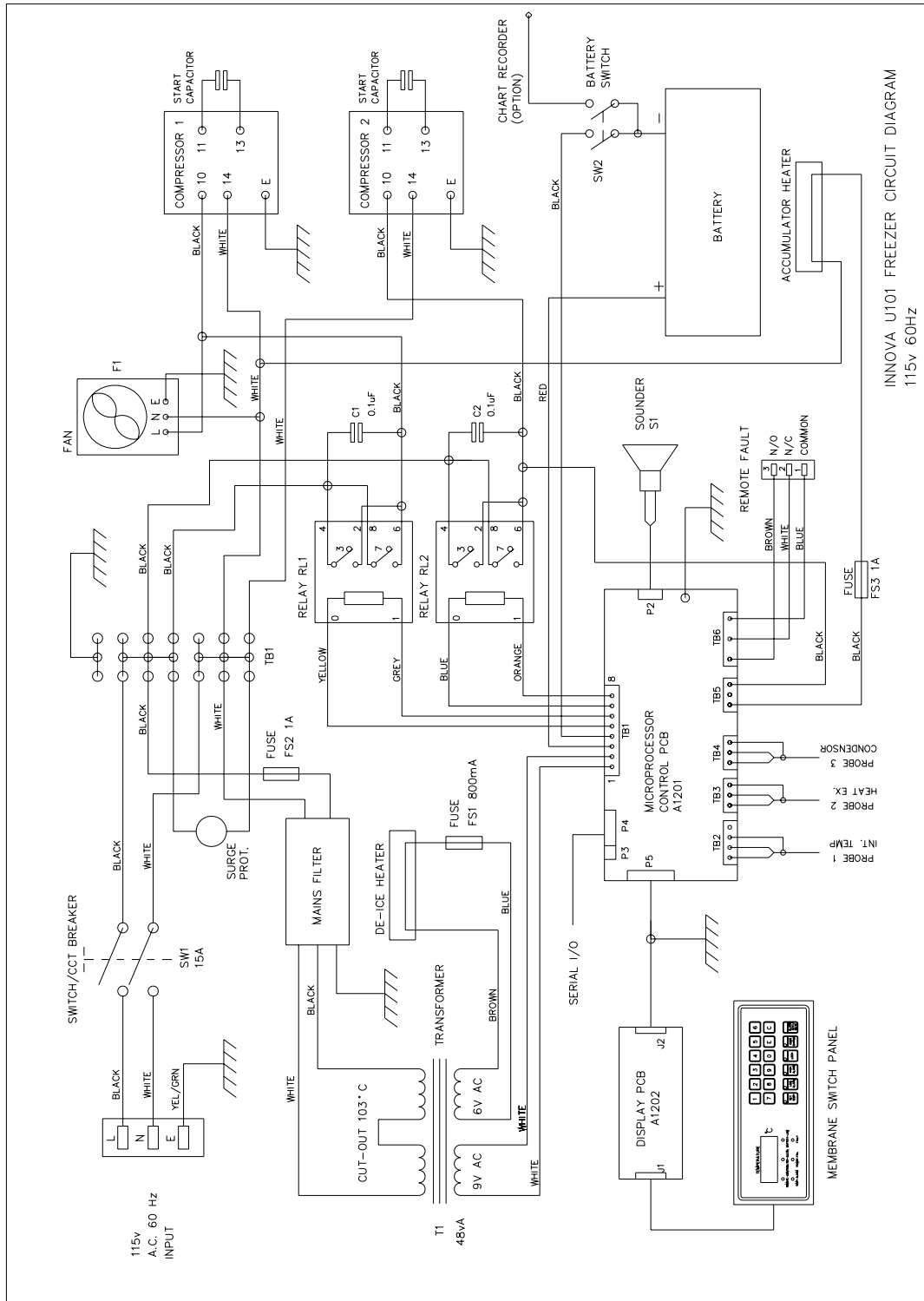
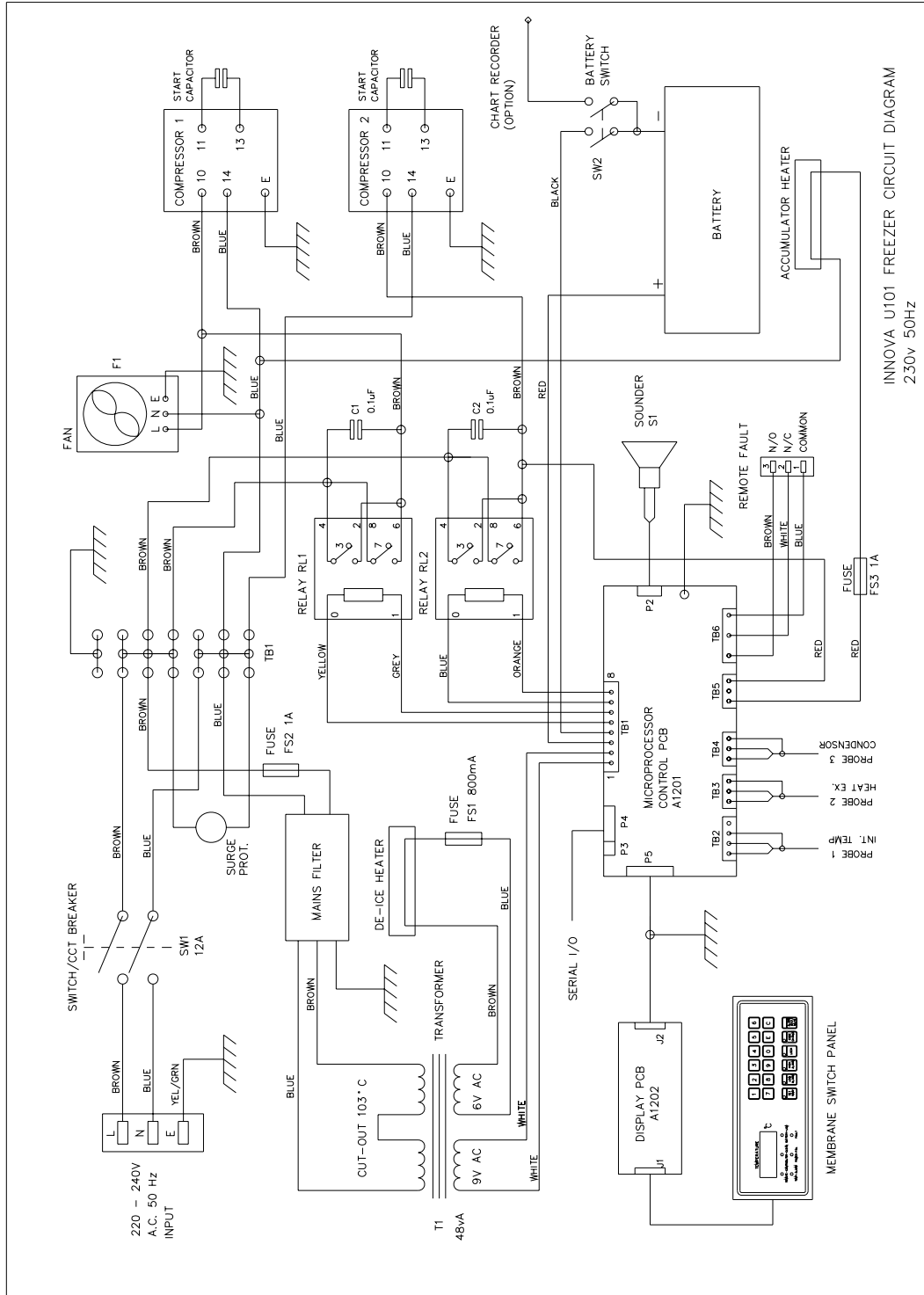


Figure 9: Circuit Diagram/Schematic for U101 Model (115V, 60Hz)



INNOVA U101 FREEZER CIRCUIT DIAGRAM
115v 60HZ

Figure 10: Circuit Diagram/Schematic for U101 Model (230V, 50Hz)



INNOVA U101 FREEZER CIRCUIT DIAGRAM
230v 50Hz

9.2 *Index of Drawings*

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