

# ***AN-920 CALIBRATION***

***SOFTWARE MANUAL for***  

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***creating calibration curves***  

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***using the AN-920***

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# Introduction

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Please read this manual carefully for proper usage.

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# Getting Started

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## 1. Tools and Materials Needed ...

- AN-920 main unit
- Communication cable “D-sub 9-pin female to female cross cable”
- PC with AN-920 Calibration Software installed
- Authentic samples for calibration

### Point of Information:

The concentration of each component in the authentic samples for calibration is known. Calibration is done using these concentration values as references, thus the values need to be accurate.

※ In general, chemical assaying is employed to obtain concentrations to be used as references.

At least four different authentic samples with varying component concentrations (four concentration levels) are required for calibration.

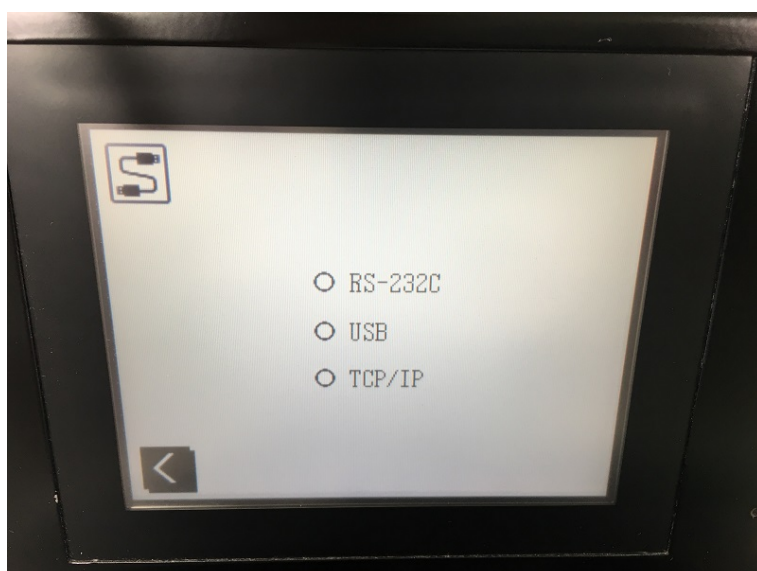
For higher accuracy of a calibration curve, using 50 to 100 authentic samples (50 to 100 concentration levels) is recommended.

## 2. Connecting

- Connect one end of a communication cable to the COM port on a PC.
- Connect the other end of the communication cable to the “RS-232C” connector on the AN-920.

## 3. Setting the AN-920

Make sure the communication setting on the AN-920 is as shown below, that is, nothing is selected.



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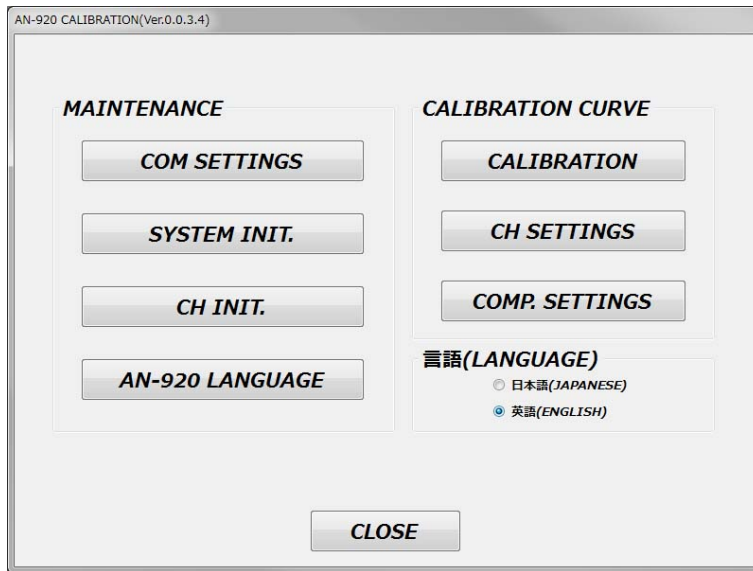
# Menu

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## 1. Opening the Software

Open the software (AN-920 CALIBRATION) to bring up the Menu screen.

## 2. Menu screen



### ➤ MAINTENANCE

- COM SETTINGS: displays the screen for configuring communication settings with a PC
- SYSTEM INIT.: displays the screen for configuring exposure time, etc. of the AN-920
- CH INIT.: displays the screen for initializing the AN-920 channels
- AN-920 LANGUAGE: displays the screen for switching languages to be displayed on the AN-920

### ➤ CALIBRATION CURVE

- CALIBRATION: displays the screen for preparing calibration curves
- CH SETTINGS: displays the screen for configuring channel names, display items, measurement conditions, etc.
- COMP. SETTINGS: displays the screen for configuring component names, units, display range, etc.

### ➤ Switching LANGUAGE

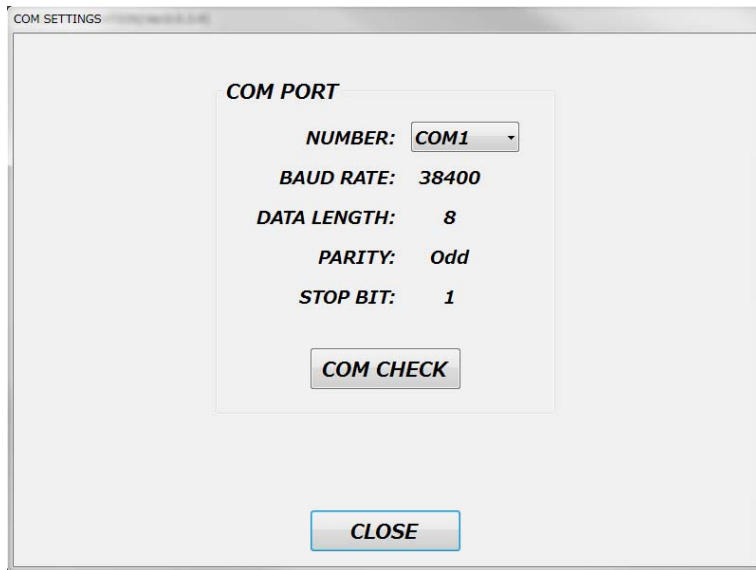
- JAPANESE / ENGLISH: switches the display language of this software

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## Communication Settings

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### 1. COMMUNICATION SETTINGS screen



COM SETTINGS

**COM PORT**

NUMBER: **COM1**

BAUD RATE: **38400**

DATA LENGTH: **8**

PARITY: **Odd**

STOP BIT: **1**

**COM CHECK**

**CLOSE**

### 2. Communication check

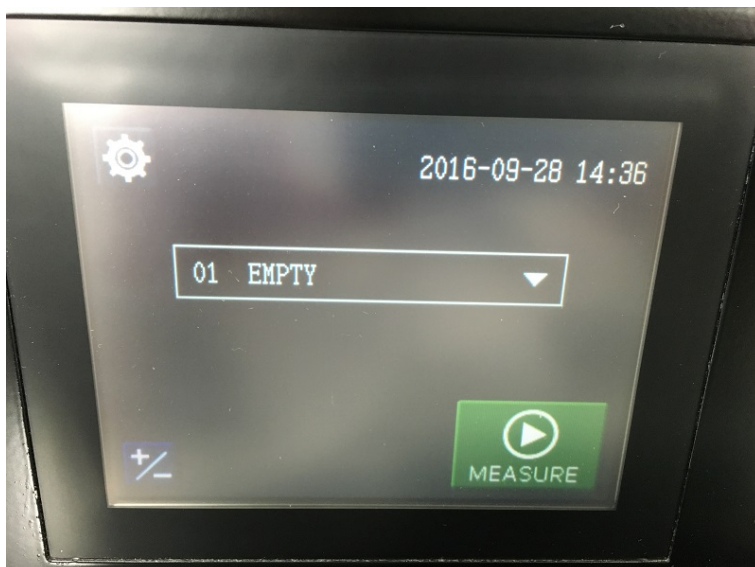
<1> Select the COM port number to which the communication cable is connected.

<2> Press [COM. CHECK] button.

<3> [COMMUNICATION CONFIRMED] is displayed if the communication status is normal.

**Note:**

Please be sure that the main screen of the AN-920 (shown below) is displayed. Otherwise the message [COMMUNICATION FAILED] will come up.



<4> Press [CLOSE] button.

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# System Initialization

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## 1. SYSTEM INITIALIZATION screen

SYSTEM INIT.

*EXP. TIME TABLE\_B*

No.	EXP. TIME	SCAN
21	40	10
22	40	10
23	40	10
24	40	10
25	40	10
26	40	10
27	64	10
28	125	10
29	250	8
30	500	4
31	1000	2
32	2000	1
33	4000	1
34	8000	1
35	16000	1
36	32000	1

AN-920 S/N: PP00004  
SPECTROSCOPE S/N: 911U0074

**SET INITIAL VALUE**

**WRITE TO AN-920**

**CLOSE**

## 2. Writing a set of exposure times for calibration to the AN-920

- <1> Press [INITIAL VALUES] button.
- <2> Press [WRITE TO AN-920] button.
- <3> Press [CLOSE] button.

### Point of Information:

The AN-920 automatically selects the optimum exposure time based on the sample transmission. In this step, you set a table of exposure times to be used in this process.

# Channel Initialization 1 of 2

## 1. CHANNEL INITIALIZATION screen

CH INIT.

**READ FROM AN-920** **WRITE TO AN-920**

CH	SAMPLE NAME	COMP.1 PROTEIN	COMP.2 MOISTURE	COMP.3 ANY
1				
2				
3				
4				
5				
6				
7				
8				

**OPEN CH PARAM. FILE** **SAVE CH PARAM. FILE**

**CLOSE**

## 2. Channel initialization

Let's look at how to set initial values to channel 1.

<1> Press [READ FROM AN-920] button.

<2> Right-click on the row for channel 1.

<3> Select [SET INITIAL VALUES].

CH INIT.

**READ FROM AN-920** **WRITE TO AN-920**

**AN-920 DATA**

CH	SAMPLE NAME	COMP.1 PROTEIN	COMP.2 MOISTURE	COMP.3 ANY
1	No Calibration			
2				
3				
4				
5				
6				
7				
8				

**OPEN CH PARAM. FILE** **SAVE CH PARAM. FILE**

**CLOSE**

### Point of Information:

Calibration is possible only on the initialized channel.

### Tip:

You can [OPEN] and/or [SAVE] files for each channel, and by using this feature, the settings from one channel can be copied to another.



## Channel Initialization 2 of 2

<4> Press [WRITE TO AN-920] button.

CH INIT.

**READ FROM AN-920** **WRITE TO AN-920**

**AN-920 DATA**

CH	SAMPLE NAME	COMP.1 PROTEIN	COMP.2 MOISTURE	COMP.3 ANY
1	No Calibration			
2				
3				
4				
5				
6				
7				
8				

**OPEN CH PARAM. FILE** **SAVE CH PARAM. FILE**

**CLOSE**

<5> Specify a range of channels (in this case, CH1 ~ CH1), and press [OK] button.

CH INIT. - WRITE TO AN-920

**RANGE OF CHANNELS TO WRITE**

CH: 1 ~ CH: 1

**OK** **CANCEL**

<6> Press [CLOSE] button.

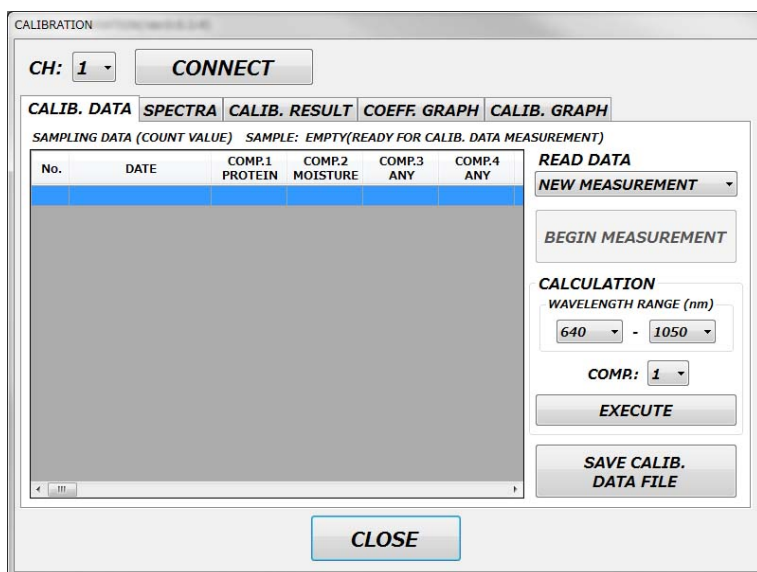
### Point of Information:

Other channels can be initialized as well in the same way.

### Tip:

The channel parameter settings for all channels can be backed-up or ported by using [OPEN CH PARAM. FILE] and/or [SAVE CH PARAM. FILE]. The command [WRITE TO AN-920] will be applied to all channels (CH1 ~ CH8).

## 1. Sampling of calibration data



<1> Select the channel for which a calibration curve is to be prepared.

<2> Press [CONNECT] button.

<3> Select [NEW MEASUREMENT] for READ DATA section.

### Tip:

If there are data from previous samplings, [OPEN CALIB. DATA FILE] can be selected. You can continue sampling from where that data file left off.

<4> Press [BEGIN MEASUREMENT] button.

### Point of Information:

[BEGIN MEASUREMENT] button cannot be used with channels that have not been initialized through CHANNEL INITIALIZATION.

<5> Sampling steps on the AN-920



Take a reference measurement without a sample.



Insert a sample, and press [NEXT].



Rotate the sample front to back (180°), then press [NEXT].



Sampling complete.

<6> Sampling of No. 1 data is complete.

CALIBRATION

CH: 1 CUT OFF

CALIB. DATA SPECTRA CALIB. RESULT COEFF. GRAPH CALIB. GRAPH

SAMPLING DATA (COUNT VALUE) SAMPLE: EMPTY(READY FOR CALIB. DATA MEASUREMENT)

No.	DATE	COMP.1 PROTEIN	COMP.2 MOISTURE	COMP.3 ANY	COMP.4 ANY
1	2016/10/17 14:22:47				

READ DATA  
NEW MEASUREMENT

BEGIN MEASUREMENT

CALCULATION  
WAVELENGTH RANGE (nm)  
640 - 1050

COMB: 1

EXECUTE

SAVE CALIB. DATA FILE

CLOSE

<7> Enter the reference concentrations.

CALIBRATION

CH: 1 CUT OFF

CALIB. DATA SPECTRA CALIB. RESULT COEFF. GRAPH CALIB. GRAPH

SAMPLING DATA (COUNT VALUE) SAMPLE: EMPTY(READY FOR CALIB. DATA MEASUREMENT)

No.	DATE	COMP.1 PROTEIN	COMP.2 MOISTURE	COMP.3 ANY	COMP.4 ANY
1	2016/10/17 14:22:47	11.8000	12.2300		

READ DATA  
NEW MEASUREMENT

BEGIN MEASUREMENT

CALCULATION  
WAVELENGTH RANGE (nm)  
640 - 1050

COMB: 1

EXECUTE

SAVE CALIB. DATA FILE

CLOSE

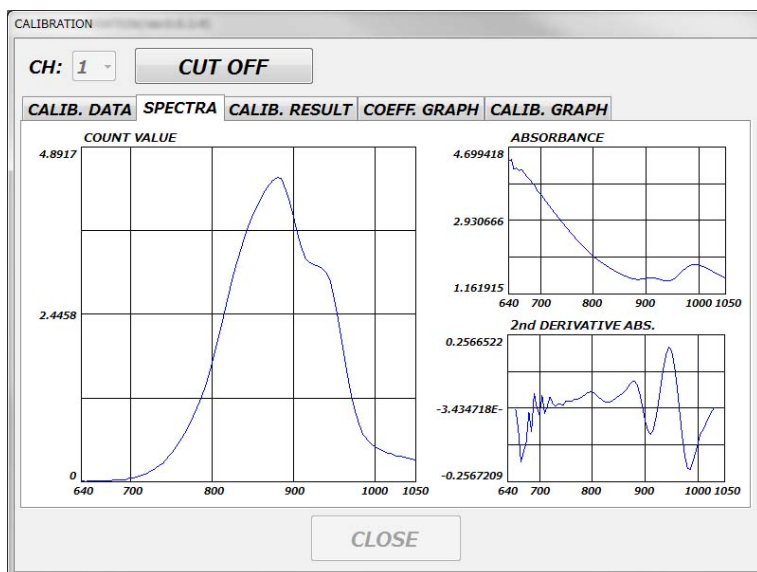
**Point of Information:**

COMP.1 is always PROTEIN.  
COMP.2 is always MOISTURE.  
COMP.3 and COMP.4 can be set to any component.

**Point of Information:**

Not all component data fields need to have values entered, as calibration curves will be prepared component by component.

<8> Select [SPECTRA] tab to check the sampled spectra.



## Point of Information:

COUNT VALUE: the higher the sample transmission becomes, the greater this value becomes.

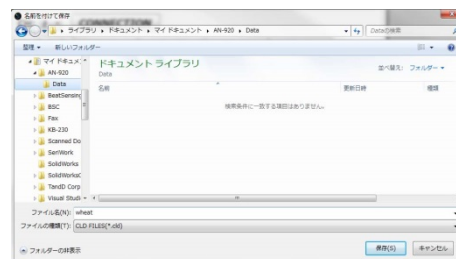
ABSORBANCE: the more the light of a wavelength is absorbed, the greater this value becomes (easily affected by overall brightness).

2nd DERIVATIVE ABS.: the more the light of a wavelength is absorbed, the smaller this value becomes (less affected by overall brightness).

<9> Select [CALIB. DATA] tab.

<10> Press [SAVE CALIBRATION DATA FILE] button.

No.	DATE	COMP.1 PROTEIN	COMP.2 MOISTURE	COMP.3 ANY	COMP.4 ANY
1	2016/10/17 14:22:47	11.8000	12.2300		



<11> Enter a file name, and click [SAVE] button.

File name: name of the sample is recommended → ex.: Wheat

<12> Do subsequent samplings by repeating <4> through <11>. Before each sampling, be sure to select the row you wish to enter the data to in order to avoid unintended overwriting.

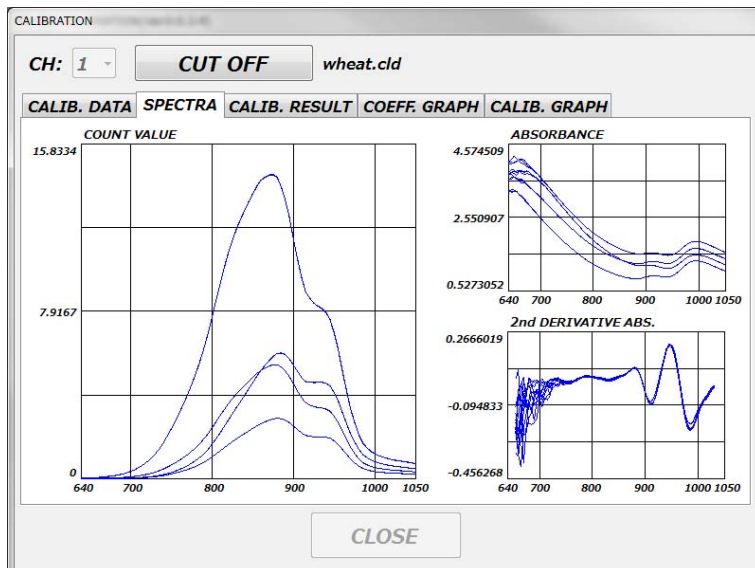
## Point of Information:

It is recommended that the same sample be measured a few times for the sake of averaging.

※ All measurements for the same sample need to be taken in succession.

<13> All the sampling is complete. → check

No.	DATE	COMP.1 PROTEIN	COMP.2 MOISTURE	COMP.3 ANY	COMP.4 ANY
1	2016/09/27 10:24:49	11.8000	12.2300		
2	2016/09/27 10:26:52	11.8000	12.2300		
3	2016/09/27 10:28:32	11.8000	12.2300		
4	2016/09/27 10:30:12	9.7000	13.0800		
5	2016/09/27 10:31:54	9.7000	13.0800		
6	2016/09/27 10:33:27	9.7000	13.0800		
7	2016/09/27 10:35:19	19.5700	9.6800		
8	2016/09/27 10:37:19	19.5700	9.6800		
9	2016/09/27 10:38:56	19.5700	9.6800		
10	2016/09/27 10:40:36	12.5500	11.0700		
11	2016/09/27 10:42:09	12.5500	11.0700		
12	2016/09/27 10:43:41	12.5500	11.0700		



## Point of Information:

The count graph above shows that any data below the wavelength of 750nm is very insignificant. The absorbance graph and the 2nd derivative absorbance graph show that the data below the wavelength of 750nm has a lot of noise.

※ The example above is the spectra of wheat. Wavelength range with low transmission (noise) varies from sample to sample.

## 2. Calibration calculation

<14> Select the wavelength range.

The screenshot shows the 'CALIBRATION' software window. At the top, there's a 'CH: 1' dropdown and a 'CUT OFF' button. Below that, the 'CALIB. DATA' tab is selected, showing a table of sampling data. To the right, the 'CALCULATION' section is visible, featuring a 'WAVELENGTH RANGE (nm)' dropdown set to '750 - 1050', a 'P: 1' dropdown, and an 'EXECUTE' button. A 'CLOSE' button is at the bottom right.

No.	DATE	COMP.1 PROTEIN	COMP.2 MOISTURE	COMP.3 ANY	COMP.4 ANY
1	2016/09/27 10:24:49	11.8000	12.2300		
2	2016/09/27 10:26:52	11.8000	12.2300		
3	2016/09/27 10:28:32	11.8000	12.2300		
4	2016/09/27 10:30:12	9.7000	13.0800		
5	2016/09/27 10:31:54	9.7000	13.0800		
6	2016/09/27 10:33:27	9.7000	13.0800		
7	2016/09/27 10:35:19	19.5700	9.6800		
8	2016/09/27 10:37:19	19.5700	9.6800		
9	2016/09/27 10:38:56	19.5700	9.6800		
10	2016/09/27 10:40:36	12.5500	11.0700		
11	2016/09/27 10:42:09	12.5500	11.0700		
12	2016/09/27 10:43:41	12.5500	11.0700		

### Point of Information:

Including a wavelength range with low transmission and high noise (as identified during step <13>) in the calculation will reduce the accuracy of a calibration curve. In the example above, a wavelength range exclusive of the high-noise range is selected (750nm ~ 1050nm).

<15> Select [1] from the [COMP.] dropdown list.

### Point of Information:

Calibration is calculated component by component.

<16> Press [EXECUTE] button.

### Point of Information:

Rows without a reference value will not be used for the calibration.



<17> Check the [CALIB. RESULT] tab.

**CALIBRATION**

CH: 1 **CUT OFF** wheat.cld

**CALIB. DATA** **SPECTRA** **CALIB. RESULT** **COEFF. GRAPH** **CALIB. GRAPH**

COMPR.: 1 SELECT ABS.: 2nd DERIVATIVE ABS. RECOMMENDED FACTOR: 2

ITEM	FACTOR2	FACTOR3	FACTOR1
CROSS VALIDATION RESULT (SECV)	2.1709	2.1711	3.8310
MULTIPLE CORRELATION (R)	0.9940	0.9988	0.9876
CONTRIBUTION RATIO (R2)	0.9880	0.9977	0.9754
STD. DEVIATION (SEC)	0.4236	0.1860	0.6077

No.	STANDARD VALUE	PREDICTED VALUE (F2)	RESIDUAL ERROR (F2)	PREDICTED VALUE (F3)	RESIDUAL ERROR (F3)	PREDICTED VALUE (F1)
1	11.8000	11.4776	0.32242	11.7748	0.02524	11.8000
2	11.8000	11.0153	0.78469	11.8351	-0.03506	11.8000
3	11.8000	11.5620	0.23805	11.7456	0.05440	11.8000
4	9.70000	10.3533	-0.65333	9.82213	-0.12213	10.0000
5	9.70000	10.1945	-0.49454	9.72483	-0.02483	10.0000
6	9.70000	10.0573	-0.35733	9.65441	0.04559	10.0000

OPEN CALIBRATION RESULT FILE SAVE CALIBRATION RESULT FILE

CLOSE

## Point of Information:

CROSS VALIDATION RESULT (SECV): better closer to 0  
 MULTIPLE CORRELATION (R): better closer to  $\pm 1$   
 CONTRIBUTION RATIO (R2): better closer to +1  
 STANDARD DEVIATION (SEC): better closer to 0

## Point of Information: Cross Validation

This is a method of evaluating a calibration curve, dividing calibration data between the calibration samples and a validation sample. Repeating this will give the standard error of cross validation (SECV).

※ RECOMMENDED FACTOR = Factor with the smallest SECV result

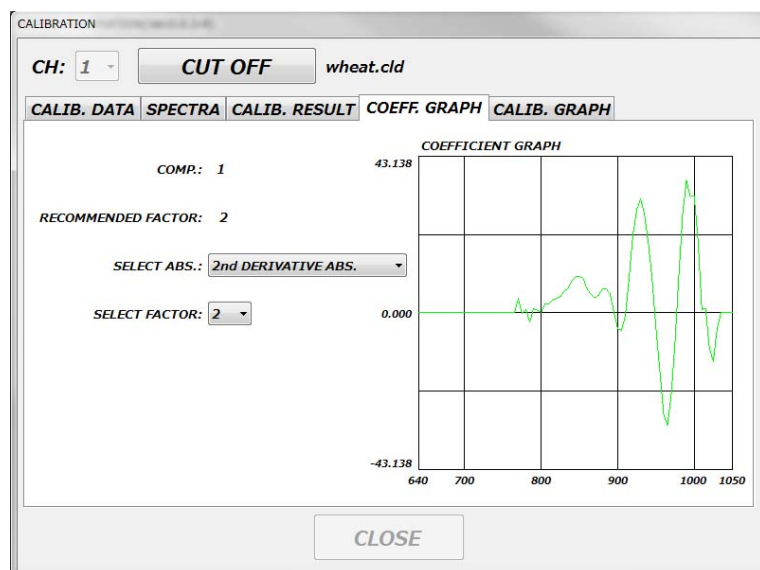
※ Too few factors → insufficient information

※ Too many factors → overfitting (measurement accuracy of unknown samples suffers)

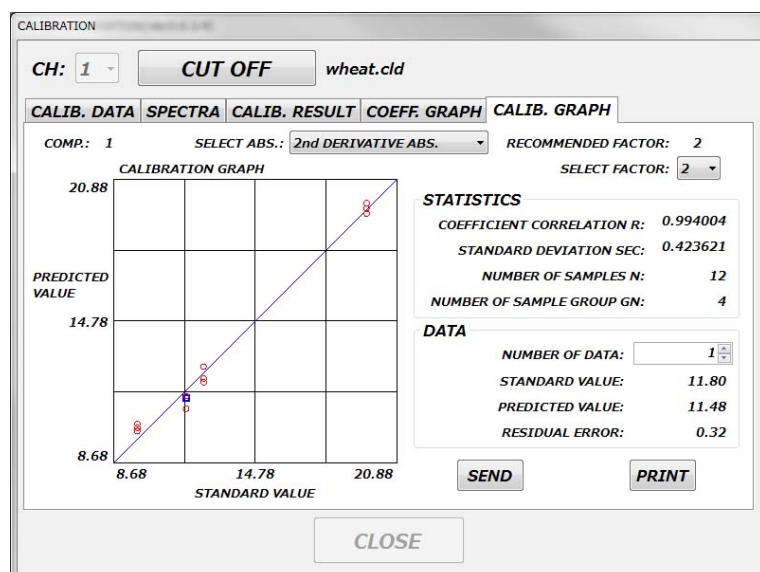
## Point of Information:

In order to minimize the affect of the change in light intensity, we recommend the use of the 2nd derivative absorbance.

<18> Select [COEFF. GRAPH] tab.



<19> Select [CALIB. GRAPH] tab.



## Tip:

Clicking the circles on the calibration graph shows you the data number. You can find out the numbers of the outlier samples with this feature and remove them. Doing the calibration calculation after removing the outlier samples will improve the accuracy of the calibration curve.

✂ Outlier sample: results of sampling mistakes or a singular contaminant sample.

<20> Press [SAVE] button.

File name: "sample name \_ component name" is recommended → ex.: Wheat\_Protein



## 3. Writing a calibration model to the AN-920

<21> Press [SEND] button.

<22> Make necessary condition choices.

CALIBRATION - SEND

USE ABSORBANCE 2nd DERIVATIVE ABS.

FACTOR 2

WAVELENGTH RANGE 750 - 1050

WRITE CH 1

WRITE COMP. 1

COMP. NAME NO CHANGE  
PROTEIN

UNIT %

DISPLAY RANGE 00.0 - 99.9

WRITE TO AN-920 CANCEL

### Point of Information:

Component names: COMP.1 is always PROTEIN.  
COMP.2 is always MOISTURE.  
COMP.3 and COMP.4 can be set to any component.  
(English one byte characters only)

Units: Choose from [%], [g], and [mg]

Display range: We recommend this range to be narrower than the one for calibration.  
When the measurement result is below this display range, the AN-920 will return "- - -".  
When the measurement result is beyond this display range, the AN-920 will return "+ + +".

### Tip:

You have an option to change the component number on this screen. This is a feature for transferring the calibration curve to a different component number from the one you have calibrated.

<23> Press [WRITE TO AN-920] button.

<24> Calibrate the next component by repeating <15> through <23>.

<25> Press [CLOSE] button.

※ If you are connected to the AN-920, the CLOSE button will be grayed out. Click [DISCONNECT] at the top of the screen first.

# Channel Settings

## 1. CHANNEL SETTINGS screen

CH 1

SAMPLE NAME WHEAT

MEAS. SEQUENCE BOTH SIDES

DISPLAY

☒ COMR1 (PROTEIN) ☐ COMR3 (ANY)

☐ COMR1 (PROTEIN) CM/DM ☐ COMR4 (ANY)

☒ CM ☐ DM ☐ Q.E.V.

☒ COMR2 (MOISTURE)

COMR1 (PROTEIN) CM - @MOISTURE 15.0 %

WRITE TO AN-920

CLOSE

<1> Select the channel for which the settings are to be changed.

<2> Enter a sample name.

**Point of Information:**

Sample names have to be in English one byte characters.

<3> Select a measurement sequence.

**Point of Information:**

We recommend choosing [BOTH SIDES] for the sake of averaging.

<4> Select components to be displayed.

<5> Enter a reference moisture value for COMP. 1 (PROTEIN) CM.

**Point of Information: COMP. 1 (PROTEIN) CM/DM**

CM: Measure the COMP. 1 (PROTEIN) with the assumption of having the specified moisture content.

DM: Measure the COMP. 1 (PROTEIN) with the assumption of being completely dry.

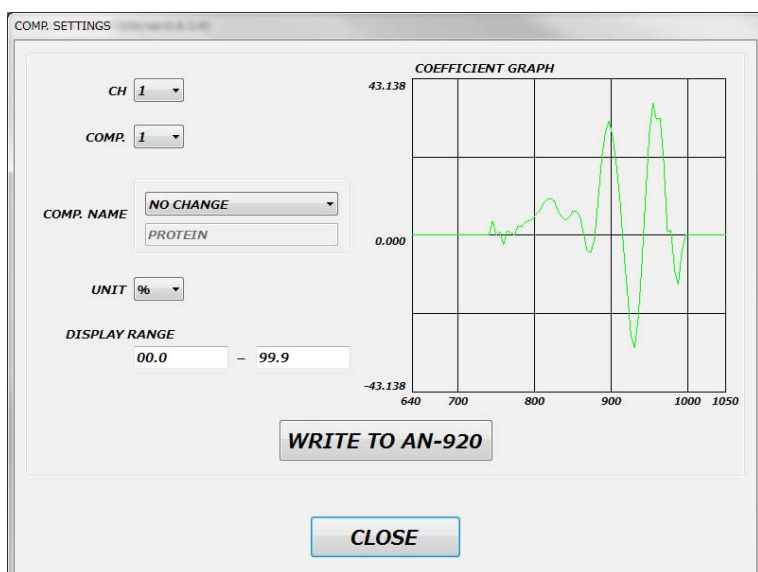
※ When the calibration curve is not set up for the COMP. 2 (MOISTURE), there is no choice to be made between CM and DM.

<6> Press [WRITE TO AN-920] button.

<7> Press [CLOSE] button.

# Component Settings

## 1. COMPONENT SETTINGS screen



- <1> Select the channel you wish to modify the component settings for.
- <2> Choose the component you wish to make changes to.
- <3> Enter the component name.
- <4> Select a unit.
- <5> Specify the display range.

### Point of Information:

Component names: COMP.1 is always PROTEIN.  
COMP.2 is always MOISTURE.  
COMP.3 and COMP.4 can be set to any component.  
(English one byte characters only)

Units: Choose from [%], [g], and [mg]

Display range: We recommend this range to be narrower than the one for calibration.  
When the measurement result is below this display range, the AN-920 will return "- - -".  
When the measurement result is beyond this display range, the AN-920 will return "+ + +".

- <6> Check the coefficient graph.

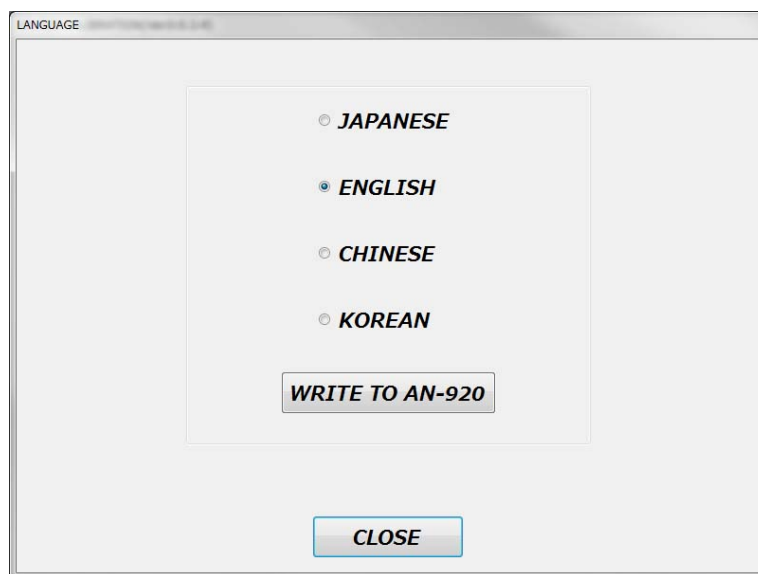
### Point of Information:

Coefficients will be all zero when the calibration curve is not set up.

- <7> Press [WRITE TO AN-920] button.
- <8> Press [CLOSE] button.

# AN-920 Language

## 1. AN-920 LANGUAGE screen



<1> Choose the preferred language for the localization of the AN-920 main unit.

<2> Press [WRITE TO AN-920] button.

<3> Press [CLOSE] button.

### Point of Information:

Language for this software can be changed from [言語 (LANGUAGE)] on the menu screen.

